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In this issue

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frontispiece

Falls are a common cause of injury in youngsters. Papers on childhood accidents and Florida's safety program appear on pp. 25–42.

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SYNOPSES

SMITH, QUENTIN M. (Public Health Service), and PENNELL, ELLIOTT H.: ***Service requirements in dental prepayment: Predictability and adverse selection. Public Health Reports, Vol. 76, January 1961, pp. 11–18.***

This paper reports the maintenance dental care experience of a group of long-term participants in a simulated dental prepayment plan which was established for study purposes by Group Health Association of Washington, D.C. The data presented demonstrate that the dental service demands of the group followed a generally predictable pattern. Despite wide variations in the demands of individuals and subgroups and trends which reflected year-to-year changes in the character of service requirements, there was consistency in average annual demand levels as measured by number of visits, treatment time, and service costs.

When the members of this group were given the opportunity of electing to continue in the program on a fee-for-service basis, as in the study plan, or on a prepayment basis, those who had had consistently greater dental needs and costs were disproportionately represented among those who chose to join the prepayment plan. The average annual cost per person of providing maintenance dental care to the joiner group under the study plan had been about 25 percent greater than that for the nonjoiners. The costs involved subsequently in operating the prepayment plan apparently reflect this adverse selection.

COMSTOCK, GEORGE W. (Public Health Service), and PHILIP, ROBERT N.: ***Decline of the tuberculosis epidemic in Alaska. Public Health Reports, Vol. 76, January 1961, pp. 19–24.***

Between 1949 and 1960, three tuberculin surveys have been done among the Eskimo population living in the Yukon-Kuskokwim delta of Alaska. The results of tuberculin tests among children less than 3 years of age were utilized to obtain an estimate of the tuberculosis infection rates. In 1949–51, the average annual infection rate was 24.6 percent; in 1957, it was 8.5 percent; and in 1960, it was only 1.1 percent. This dramatic decline appears to have resulted not only from improvements in social and economic conditions but particularly from a vigorous antituberculosis campaign with emphasis on casefinding, isolation, and treatment.

STALLONES, REUEL A. (University of California School of Public Health), and CORSA, LESLIE, Jr.: ***Epidemiology of childhood accidents in two California counties. Public Health Reports, Vol. 76, January 1961, pp. 25–36.***

Beginning in 1957, reports of accidental injuries of children under 15 years of age were collected from the emergency services of 23 of the 24 non-Federal hospitals of Alameda and Contra Costa Counties, Calif. There were 27,623 case reports in 1957 for an attack rate of 78.2 per 1,000. These data plus data from a 2-week survey of accidental injuries treated in physicians' offices indicated that the total attack rate for medically attended injuries in this age group was approximately 150 per 1,000 children for the year.

The cases were classed according to type of injury and type of accident. Slightly more than half the injuries were contusions, abrasions, lacerations, sprains, or strains. Fractures accounted for 7 percent; head injuries, 3 percent; burns, 3 percent; and poisonings, 8 percent. By type of accident, falls constituted the largest category, followed by incidents involving being struck by or striking a hard object, ingestion, and automobile accidents.

The overall risk of accidental injury increased rapidly with age to a peak at 2 years, and decreased slowly thereafter. However, sports and games accidents increased throughout the age span and automobile accidents remained high after reaching a peak in a young age group.

These data have been useful in clarifying the relative significance of various kinds of accidents and injuries and in providing information on which to base more intensive studies.

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SYNOPSES

GOLDSTEIN, HYMAN (Public Health Service): *Problems of the statistician in collaborative research. Public Health Reports, Vol. 76, January 1961, pp. 43–50.*

The problems of the statistician in collaborative research are outlined, using as an example a multi-institutional and multi-discipline study, supported and coordinated by the National Institute of Neurological Diseases and Blindness, to determine the relationship of certain biological, genetic, and environmental factors in the parents to the occurrence of abnormalities in the products of conception. This study of 50,000 pregnancies, with followup of live offspring to 6 years of age, involves the cooperative efforts of 15 institutions throughout the country.

The low incidence of many conditions and defects in the products of conception and the great number of variables in the study make necessary supplementation of this prospective study by various methods, such as retrospective studies. Case selection problems are discussed, particularly as they concern suggestions by clinicians (*a*) to oversample high-risk cases to increase yield of defective outcomes or (*b*) to relate solutions of these problems to ease and consistency of data collection. The problems to be faced in sample maintenance are emphasized. The questions of bias, uniformity, reliability, and validity of collected data, as well as contemplated methodological tests, are reviewed. Some proposed approaches to analysis of the data are indicated.

BEARD, J. HOWARD, and WOHLGEMUTH, MARGARET C. (Anne Arundel County Health Department): *Maryland citizens in action for community health. Public Health Reports, Vol. 76, January 1961, pp. 67–72.*

In Anne Arundel County, Md., lay health associations maintain and support 10 community health centers built largely by their own efforts. Only 2 of their 10 buildings were financed by well-to-do philanthropists. With services provided by a combination of volunteers and the county, maintenance and management of the health centers are assumed by lay health associations, which now own nine of the buildings. A countywide lay health council, representing the neighborhood associations, has functioned since 1946. There appear to be few if any parallel situations in other parts of the country, although other communities have formed lay health associations. The Anne Arundel phenomenon is discussed as a factor in public health administration.

KULCZYCKI, L. L. (Harvard Medical School), and MACLEOD, K. I. E: *Cystic fibrosis: a community challenge. Public Health Reports, Vol. 76, January 1961, pp. 85–90.*

Cystic fibrosis weighs heavily upon the afflicted families. It warrants a program of aid for the individual patient and assistance to the family income to meet the expenses of necessary and continuous medical care. The community, acting through existing public health services, must help by providing for the early detection of the disease and developing facilities for casefinding, diagnosis, and treatment. A standardized nomenclature of this disease and proper pathological and statistical coding are needed. Uniform channeling of the statistical data currently available and continuously developing through followup studies is urgent.

Owing to the complexity of the disease and the difficulty in the correlation and interpretation of the clinical and laboratory findings, it is postulated that the diagnosis and management of the patient affected with cystic fibrosis should be supervised by physicians who have specialized knowledge of this relatively new clinicopathological entity. Several pediatric centers have accumulated much experience in handling the overall problem of cystic fibrosis. But any such service, particularly the supervision of nutrition, rehabilitation, breathing therapy, proper bronchial drainage, and adequate use of mist and aerosol spray, requires considerable cooperation on behalf of the patient by the parent, properly trained physician, nurse, and physiotherapist. The voluntary organization of parents and interested citizens has an important function in the development of these needed services.

Coverage, Costs, and Controls in Voluntary Health Insurance

ANNE R. SOMERS and HERMAN M. SOMERS

TWO overriding problems confront voluntary health insurance today: Can group benefit coverage be expanded far enough, fast enough, and at a feasible price to meet, for the majority of employed workers and their families, the rising tide of demand? For those who cannot generally qualify for group insurance, notably the aged, and for whom government is already paying a substantial portion of total medical costs, what will be the future relation between public financing and private medical care programs? Although these problems are obviously interrelated, this paper discusses the first one only.

The central issue of group insurance—which means, primarily but not exclusively, employee insurance—can be summarized as the problem of the "3 C's": coverage, costs, and controls. This bit of shorthand indicates both the challenge and the solution. There are, of course, other important issues. For example, several million workers and their families are denied the benefits of group coverage simply because they work for employers with firms or with profit margins too small to have a systematic employee benefit program. Equity requires that some method be devised for bringing them under the umbrella of insurance protection. This can be done. One approach is already under study by the task force appointed by Governor Rockefeller of New York.

Numerically, however, and in terms of national policy, the overriding issue with respect to employee insurance is whether benefit coverage can be expanded far enough and fast enough, at a price which the average employer or employee, or both, are willing to pay, to prevent the mass purchasers of group insurance from following the lead of the aged and turning to the government for assistance. If so, how?

In the attempt to answer these questions, we shall review briefly the present state of the "3 C's."

Challenge of "Comprehensive" Coverage

What is the situation with respect to current levels of health insurance benefits? How well founded is the insistent demand for more? The most important single fact is that, after a decade and a half of continual pressure and tremendous activity on all fronts, health insurance is still meeting on the average less than one-fourth of our private medical care bills (the costs of physicians' services, dental care, nursing care, hospitalization, drugs, and appliances), whether measured in terms of total private expenditures for the Nation as a whole or total expenditures of insured families. These are disappointing statistics. Unfortunately, however, they are well documented.

The ratio of total health insurance benefits

Mrs. Somers is research associate at Haverford College, Pennsylvania, where Mr. Somers is professor and chairman of the political science department. *Data included in this paper, presented to the Inter-Association Committee on Health, in Chicago, March 4, 1960, were derived from a study the authors conducted under the sponsorship of the Brookings Institution. The views are the authors'.*

to total private expenditures for medical care (including the net cost of insurance) in 1958 was 23.6 percent (table 1). In that year, according to the Health Information Foundation and the National Opinion Research Center (HIF–NORC), insurance benefits averaged 24 percent of the total costs of insured families (*1*). In 1953, the ratio was 19 percent. The improvement has been much less than the frequent rises in insurance premiums would suggest.

The most disappointing fact, probably more significant than the actual current figures, is the recent slowdown in the rate of improvement. From 1948 to 1954, the benefit-expenditure ratio rose 10.5 percentage points, well over 100 percent. But from 1954 to 1958, the increase was only 5.2 points, or only 28 percent. While we cannot expect a constant progression in rates of increase, the relatively sharp falloff from what is still a small percentage base suggests a decline in the dynamism of expansion.

With respect to hospitalization alone, insurance coverage is, of course, far more adequate. Among insured individuals who actually received some hospital benefits, insurance appears to be meeting 80 percent or more of their hospital charges. And yet it must come as a shock to realize that only a little more than half of the Nation's total private hospital bill is met through insurance. Even in this area, where the most progress has been made, we appear to be reaching a plateau. In 1958, for the first time, there was virtually no increase, less than 1 percentage point, over the previous year.

Some advance is still being made with respect to benefits for physicians' services—there was an improvement of 1.6 percentage points between 1957 and 1958—but, in general, it seems that the drive for comprehensive coverage, about which so much is heard, is at the moment largely confined to rhetoric.

There are two major reasons for this situation: A much larger proportion of the consumer's medical dollar goes for uninsured types of medical care than we used to think, and most of the quantitative gains in benefit coverage in

Table 1. Amount of private expenditures for medical care and percent met by voluntary health insurance, selected years, 1948–58

Year	Total medical care expenditures		Hospital services [1]		Physicians' services [2]	
	Amount (in millions)	Percent met by insurance	Amount (in millions)	Percent met by insurance	Amount (in millions)	Percent met by insurance
	Net cost of insurance excluded					
1948	$7,391	8.2	$1,689	26.9	$2,360	6.4
1950	8,346	11.9	2,126	32.0	2,462	12.7
1952	9,709	16.5	2,602	41.3	2,702	19.6
1954	11,267	19.3	3,167	45.5	3,162	23.3
1956	13,679	22.0	3,905	51.8	3,590	27.7
1957	14,683	23.7	4,221	54.6	3,831	30.5
1958	15,777	24.6	4,761	54.4	4,011	32.1
	Net cost of insurance included					
1948	$7,647	7.9	$1,881	24.2	$2,424	6.2
1950	8,645	11.5	2,315	29.4	2,572	12.1
1952	10,098	15.9	2,834	37.9	2,859	18.5
1954	11,844	18.4	3,492	41.3	3,414	21.6
1956	14,288	21.1	4,251	47.6	3,853	25.8
1957	15,353	22.6	4,596	50.1	4,125	28.4
1958	16,397	23.6	5,102	50.8	4,290	30.0

[1] Includes hospital outpatient services.
[2] Includes some payments for services of nurses, dentists, and laboratories.
SOURCE: Derived from *Social Security Bulletin*, December 1959, table 7, p. 9.

the areas already generally insured, especially hospitalization, have been canceled out by the steady rise in costs. In the face of this dilemma, insurance negotiators and administrators are earnestly searching for ways of satisfying the insistent demand for broadened coverage which may circumvent the erosion of rising costs.

There are numerous encouraging experiments directed toward a change in the typical pattern of benefits so as to cover a larger segment of the total family medical care budget. Major efforts to achieve comprehensive coverage on a general basis have been made by the "comprehensive" prepayment group practice plans and by the insurance companies in their "comprehensive" major medical policies. Several million persons are enrolled under each of these experimental forms.

Thus far, we know practically nothing as to the actual effect of comprehensive major medical insurance on the benefit-expenditure ratio. The current study being made by the Columbia University School of Public Health and Administrative Medicine for the labor-management financed Foundation on Employee Health, Medical Care and Welfare—a comparative survey of four kinds of coverage including the GE–Metropolitan major medical plan—should throw some light on the comparative value of this type of insurance.

We already know, however, as a result of the work of HIF and NORC, what happens to the average benefit-expenditure ratio under a leading closed-panel plan, the Health Insurance Plan of Greater New York (HIP) and under a comprehensive prepayment plan with free choice, Group Health Insurance (GHI) of New York City (*2*). It came as a considerable surprise to many advocates of these types of organizations to discover that they covered only a little over one-third of their enrollees' total medical costs.

On the other hand, their record with respect to the insured portions of medical expense was excellent, especially in the case of HIP. This plan, together with Blue Cross, met 88 percent of the subscribers' average hospital costs and 92 percent of surgical costs. HIP covered 80 percent of the cost of all physicians' services; GHI, 59 percent.

The real surprise in this study is not the fact that drugs, dentistry, and other generally uninsured services pull down the overall benefit-expenditure ratio, but the extent to which they do so. The explanation for this phenomenon is complex and points up the extreme difficulty of achieving anything like comprehensive coverage. The fact that insured people utilize more medical care, including uninsured care, than uninsured people is now generally acknowledged. Less recognized is the effect of different types of insurance coverage on the distribution of family medical costs. This is clearly indicated in table 2 based on six separate surveys made by HIF–NORC between 1953 and 1957. The cost of physicians' services as a whole constitutes a relatively stable portion of the consumer's average medical dollar,

Table 2. Percentage distribution of total expenditures for medical care, by category of service, from various surveys of the Health Information Foundation and the National Opinion Research Center [1]

Service	Group Health Insurance (1957)	Health Insurance Plan (1957)	Birmingham Blue Cross-Blue Shield (1953)	Boston Blue Cross-Blue Shield (1953)	Aetna (1953)	Nationwide insured (1953)
Hospital	19	9	18	23	24	21
Physician	32	[2] 33	35	31	34	38
Surgery	8	4	8	8	8	8
Obstetrics	2	1	4	4	5	4
Other	21	28	23	20	21	26
Drugs	21	26	20	17	16	14
Dentist	20	26	16	19	18	17
Other	8	6	10	10	8	12

[1] Percentages do not always add exactly to 100 percent or to the sum of their components because of rounding.
[2] Based on unit charges to GHI subscribers.

SOURCE: Derived from reference 2, table 6, p. 21.

roughly one-third. By contrast, there is wide variation in the hospital, drug, and (to a lesser extent) dental components, as well as in the surgical and obstetrical portions of physicians' services. HIP represents the extreme of this variation, with hospital care accounting for only 9 percent of total expenditures compared with 18 to 24 percent under other types of insurance, whereas drugs and dental care each took 26 percent.

One could long speculate on all the implications of these fascinating data. Here we are concerned primarily with three separate but related facts which bear intimately on the drive for comprehensive coverage: (*a*) the urgent need for insurance of drug and dental costs in addition to the generally recognized need for coverage of regular physicians' care; (*b*) the potentially high cost of insuring these two items in view of the demonstrated elasticity of demand; and (*c*) the possibility of paying for at least part of the additional cost by savings in hospital and surgical expenses.

Several insurance companies and prepayment plans are already experimenting in these areas. Dental insurance got off to a slow start, but a breakthrough in that area may be imminent. Between 1958 and 1960, the number of prepaid dental schemes is reported to have doubled (*3*). This year some 200 plans are said to be operating, and the number of enrollees with comprehensive dental benefits has climbed to half a million or more.

The phenomenal rise in the use of drugs, even without insurance coverage, is enough to frighten the boldest actuary. And yet, here too, insurance history is being made. Most major medical policies now cover prescriptions; evaluation of this experience is urgently needed. Also, alongside the prevailing pattern of continuous increase in the use of drugs, a few modest experiments appear to indicate that they can be controlled and insured for reasonable premiums.

Group Health Cooperative (GHC) of Seattle, Wash., for example, covers in its regular prepayment plan most prescribed drugs except insulin, other hormones, and vitamins (unless there is a clinical diagnosis of a vitamin deficiency) for each separate condition for up to a year. In 1959, GHC reported an average of 3½ prescriptions per year per covered member and a total annual cost per member of $4.99. Contrast this figure with the $36 spent by the average HIP member for noninsured drugs in 1957! Despite the limitations in GHC drug coverage, the difference remains startling.

The key to this low cost, according to GHC officials, is a formulary which provides a limited number of products, and so avoids duplications and prescribing by brand name. The problem of avoiding wasteful duplication in drug manufacture without discouraging new research is difficult, but an increasing number of pharmaceutical leaders as well as physicians and consumers appear convinced that something will have to be done if government regulation of drug prices is to be avoided.

If substantial coverage of these two areas could be achieved in the next few years, a significant breakthrough toward meaningful comprehensive coverage could be achieved and a substantial victory chalked up for voluntary health insurance. But it will not be enough to insure final victory. This will require close and perhaps painful attention to the problem of costs, both in the newly insured areas and in the more traditional fields of hospital and surgical services.

Threat of Rising Medical Costs

The dramatic rise in the costs of medical care is well known. However measured—on the basis of national, per capita, or unit costs, in current or constant dollars, considering only medical services or all medical items, over the long run or the short run, as a proportion of gross national product or of personal disposable income—the rise has been far greater than for the cost of living as a whole. For example, average per capita expenditures for personal medical care increased more than 80 percent between 1948 and 1958. As a proportion of disposable personal income this represents a rise of 30 percent in 10 years.

In part this was due to increased use of medical goods and services. Our calculations, based on Department of Commerce and Social Security Administration expenditure data, indicate that utilization rose about 27 percent during this period (*4*). To a larger degree, however, the rise is attributable to a 43 percent advance

in medical prices, which were spiraling upward far more rapidly than other prices. Indeed the most disturbing aspect of the price rise is its acceleration and the increasing disparity with general price trends. Between 1947–49 and 1959, medical care prices rose twice as much as the general cost of living. But during the last year, 1958–59, when general prices rose less than 1 percent, medical prices continued their lively pace with an increase of more than 4 percent.

This persistent rise is the major factor in the ever-increasing loss ratios of which all carriers and plans complain and in the extreme financial difficulties of many Blue Cross plans. It threatens both the comprehensive major medical and comprehensive prepayment plans with retrenchment, at a time when both should be expanding, and has generally made it more difficult to expand benefits, not to mention being a major cause for increasing government intervention in the problem of the aged. For all these reasons many experts feel that costs have become the greatest single issue facing voluntary health insurance today.

Not everyone agrees with this view. Some take the position that there really is no cost crisis as yet—at least so far as group insurance is concerned. In spite of all the rate increases, they say, health insurance still represents an insignificant item in industry's overall budget, perhaps no more than 2 to 3 percent of total labor costs, and less than pensions. Furthermore, they say, as costs rise, it simply means that employees will take a little less of their next pay increase in the form of direct wages and a little more in the form of medical benefits. And since the total cost can be spread so easily and painlessly throughout the consuming public, so runs the argument, nobody really has to worry.

Indeed there seems little doubt that Americans are destined to, and probably should, spend more than they now do for medical care. Not only is scientific advance making more and better health protection available, but rising living and educational standards and the aging of the population are making the demand larger and inexorable. A greater proportion of the gross national product and the corporate dollar for this purpose could easily be justified.

But if the price of medical care continues to rise at its current rate of 4 percent a year, and health insurance even faster as it must to keep up with the greater rise in hospital prices, still the major component in insurance benefit payments, then we may find that all the additional money is absorbed in maintaining the present level of benefits. In fact, premiums could continue to rise substantially while benefits actually decline.

Moreover, there are increasing indications that management and labor really are concerned about the cost problem. An example is the high-level National Conference on the Rising Costs of Medical and Hospital Care, held at Arden House, Harriman, N.Y., in March 1960 under the sponsorship of the Foundation on Employee Health, Medical Care and Welfare. Another is the new steelworkers' agreement. The steel employers have agreed to pay the full cost of their employees' health insurance, but there is a unique clause which permits management to deduct any rises in the cost of insurance from cost-of-living escalator raises which the workers would otherwise get. This should have the effect of making the individual worker extremely conscious of, and probably resentful of, any future rises in health insurance costs.

The price of health insurance is primarily, of course, a problem of medical, not insurance, prices. In 1958, the net costs of all health insurance amounted to less than 4 percent of the total private medical bill and about 14 percent of total premiums (*5*). The fact is that group health insurance has become largely a "cost plus" operation, and when we talk about the rise in cost of health insurance we are inevitably talking about the rise in cost of medical care.

The matter is not quite that simple, however. It is increasingly recognized that the presence of insurance is not a neutral force in the medical marketplace however much its proponents may wish it to be so. The influence of various types of insurance on subscriber utilization and expenditures has frequently been noted. Consider, for example, the effect of the HIP type of coverage in reducing hospital use and, therefore, costs (*6*). Blue Cross of Philadelphia has found that hospital use is consistently higher

for subscribers with Blue Shield medical and surgical coverage (*7*). At one point, before it undertook necessary reforms, the United Mine Workers medical care program faced financial disaster, so great was the increase in the costs of hospital and surgical services by its beneficiaries (*8*).

It seems clear that health insurance, originally designed to ease problems of medical costs, has actually contributed, by its effect on utilization and on prices in a scarcity market, to intensification of the problem. This is not to deny, in any way, the great good which insurance has already accomplished. However, if it is to continue to play a constructive role in the easing of medical costs for consumers and in the stabilization of income for producers, it must acknowledge, more forthrightly than heretofore, its influence on costs and be prepared to accept the corollary responsibilities.

Administrative Controls

Fortunately, the same insurance mechanism which has aggravated the cost problem also appears to contain the possibility for an equitable solution: an administrative mechanism for reconciling the three great objectives of economy, quality, and free choice.

As already indicated, the closed panel is one reasonably effective method of controlling some forms of medical cost. The HIP record, for example, which, even in this decade of inflation, has not raised its premiums since 1953, is impressive. This fact, made possible by the plan's capitation method of payment to affiliated groups, has undoubtedly resulted in some hardship to individual doctors, especially the best and most dedicated of them. But in the general shortage of medical personnel, it is not likely that it could have held together an organization of 1,000 physicians, with the reputation they have established, if any inordinate economic sacrifice had been required. The HIP experience, of course, is not definitive; not all closed-panel plans have such a record.

It is not necessary, however, to confine the discussion to closed-panel practice. There are examples of effective cost controls among doctors in solo fee-for-service practice. Among those that come readily to mind are the San Joaquin County (Calif.) Foundation for Medical Care and two Canadian plans, Windsor Medical Services and the Saskatchewan Swift Current program. Let us sketch briefly the functioning of the San Joaquin program.

The foundation is not a carrier. It is the brainchild and a legal subdivision of the San Joaquin Medical Society. It was organized in 1954 partly as a countermeasure to the success of the Kaiser Foundation Health Plan. Its officers are appointed by the county society, and it is housed in the same building as the society in Stockton. The relations between the foundation and the society could hardly be closer. Nevertheless, in practice as well as in philosophy, it has construed its role as a protector of consumer interests as well as those of the physicians.

The functions of the foundation include the setting of benefit standards for all policies marketed as foundation approved, the review and payment of claims, and the establishment of maximum fee schedules for physicians' services. The actual underwriting and sale of policies is left to insurance companies which are willing to accept the foundation's liberal benefit standards and vigorous claims procedures.

Participating physicians, about 98 percent of all in the county, practice on a solo fee-for-service basis, but they agree to accept the foundation's fee schedules as full payment, thus guaranteeing service benefits and certainty-of-costs to the insured and eliminating the whole problem of income limits which plagues Blue Shield. The physicians must reapply annually for membership.

The key to the foundation's control is its insistence on handling all claims itself. Each one receives a twofold review—a contractual review by specially trained clerks and a medical review by a rotating committee of physicians who give an hour a week to this work and who, as members of a committee of the county medical society, have the authority to call up a colleague and insist on an adjustment, if necessary. This review is directed as much at the quality of care as the price. It represents an extension of the principle of internal medical audit, familiar to most accredited hospital staffs, to outpatient care. The results, according to foundation officials, are generally educational rather than

disciplinary. But enough discipline has been applied, including refusal to readmit one physician, to act as a powerful influence on the whole program. The San Joaquin experiment has received the compliment of imitation by 13 other California counties.

Another illustration, from the hospital insurance field, is Blue Cross of Philadelphia. This plan, one of the oldest and largest of the Blue Cross group, has experimented over the years with numerous institutional devices for exercising some discipline over the rising costs of hospital care and hence its own subscription rates. One is a negotiated hospital reimbursement formula, which does not pay on the basis of the individual hospital's costs or charges, however discounted, nor on the basis of a flat community rate, as was done originally. The present formula is a complex one which attempts to incorporate the best features of all these approaches. Its aim is to build in incentives for more efficient hospital operation by rewarding, within limits, the more efficient institutions and penalizing the less efficient.

One especially interesting feature divides the affiliated hospitals into 10 categories according to their patients' average length of stay and then adds within these categories differential payments, varying from 200 percent of the basic rate for the first day to 75 percent for all days over the average in the appropriate category. The purpose is to create a financial incentive for the hospitals to discharge patients as soon as possible. To try to cut down possible misuse of hospital services by consumers, this plan has also introduced a deductible contract, outpatient diagnostic benefits (now carried by about 60 percent of the enrollees), and visiting nurse services for older subscribers.

In 1958, a physicians' review board was created with the backing of the Philadelphia County Medical Society to check on practices of physicians that might lead to unnecessary admissions, overuse of ancillary services, and unnecessarily prolonged stays. The board is composed of 34 outstanding local doctors, with a leading surgeon and an internist as co-chairmen and an advisory council of six which includes such eminent men as Dr. I. S. Ravdin and Dr. John H. Gibbon, Jr. The doctors, divided into seven groups, are continuously engaged in review of hospital records. The plan's new electronic equipment makes these available in detail for every case admitted to every hospital.

It is impossible to measure precisely the results of these various efforts at cost regulation. They have certainly not produced anything like a price freeze. They were not intended to do so. Two large rate increases took place in Philadelphia in 1958 and 1959 to the accompaniment of widespread consumer objections, public hearings, and an adjudication by the insurance commissioner which has become part of health insurance history (*9*). The point is to illustrate that measures are available for exercising some discipline over medical care costs, even hospital costs. As a result, all the plans cited have been able to maintain service benefits and assured coverage for their enrollees, even the repetitively ill and other high-cost risks.

The cases mentioned are, of course, conspicuous exceptions to the general policy of laissez faire—of allowing the seller to charge what he will. Indeed, even these plans have encountered bitter opposition. A portentous policy conflict is currently taking place in Philadelphia over the Blue Cross reimbursement formula. In 1959, about half the affiliated hospitals refused to renew the existing contract. This issue is currently being investigated, at the request of Blue Cross and most of the hospitals, by a committee of the American Hospital Association. Meanwhile, eight Catholic institutions served notice, in January 1960, that they would cancel their Blue Cross affiliation on March 31, if their demand for reimbursement based on individual charges was not met.

The nature of their demand, while complicated by secondary factors, goes to the heart of the control issue. They insist that Blue Cross' function is solely to pay the bills of its subscribers. They deny that it should have any favored position on rates, or the right to negotiate terms and conditions, or to check their books, records, or administration.

Blue Cross maintains that capitulation to such a demand would remove incentives to more efficient cost-conscious hospital administration and would inevitably lead to higher hospital rates. This would force a further rise in Blue Cross rates and result in the loss of subscribers. Some of these would switch to indemnity contracts;

others would lose coverage altogether. In either case, the hospitals would have to carry a larger proportion of nonpay or part-pay patients. In brief, the plan maintains that by exercising reasonable protection of subscriber interests through attempts to keep prepayment rates within bounds it is also serving the best interests of the hospitals.

In a statement to the press, the "lay representative" of the disaffiliated hospitals—a Philadelphia insurance broker—accused Philadelphia Blue Cross of a "conflict of interest." The plan is acting in a dual and conflicting capacity, he claims, as a seller of hospital insurance and "as a social agency with power to dictate the administrative procedures of hospitals" (*10*). Herein is the heart of the issue: Overlooking the political hyperbole in such debating terms as "power to dictate," are these two functions really in conflict or are they complementary? Was Philadelphia Blue Cross going beyond its proper function or discharging a necessary duty? Does the plan, which provides about 70 percent of patient-days in Catholic hospitals and serves 70 percent of the city's population, have the responsibility to represent its subscribers as well as the hospitals or not?

Officials of the Philadelphia plan believe that if they can establish this broad authority it will mean a notable victory for the entire voluntary health insurance movement. It will mean that it has the authority to keep its house in order, balance its books, and tackle with some assurance of success the problem of extending benefits. If the authority cannot be established, if the majority of providers and subscribers do not sustain it in this challenge, an important test case for the future of voluntarism will have been lost, including the possibility that the plan may have to abandon its traditional responsibility for the aged. A big step will have been taken toward abdication of responsibility by the voluntary agencies and the likelihood of public intervention.

Many hospital officials, in addition to spokesmen for the Catholic institutions, see the issue quite differently. Addressing the American Hospital Association in 1959, one of Philadelphia's ablest administrators said (*11*):

"Do any of you believe that Blue Cross is better versed in the complexities of hospital administration than trained hospital administrators and that Blue Cross should be given dictatorial powers to compel hospitals to follow their instructions concerning ways and means of operating hospitals more efficiently? . . . If he (Insurance Commissioner of Pennsylvania) attempts to utilize his alleged power it will drastically limit the control of these hospitals by their administrators and their boards of trustees. The commissioner apparently intends to delegate his policing power to the several Blue Cross plans of this State."

In this view, opposition to controls apparently extends to any form of "outside interference." Supervision by private agencies is condemned in virtually the same terms as public regulation.

Discussion

In summary, there are two trends which, if allowed to continue unchecked, seem to threaten the future of voluntary health insurance. These are the slowdown in the rate of improvement in benefit coverage and the persistent rise in the costs of medical care.

Potentially, ways to offset both these trends are available—partly through the extension of insurance to the major uncovered areas of medical costs, especially outpatient physicians' services, dental care, and drugs; and partly through the voluntary application of cost controls, preferably by the vendors themselves but, if that proves unfeasible, by the health insurance carrier or plan. The first of these developments is likely to come about more or less automatically; the major problem here is speed. The second, however, requires a conscious policy decision on the part of the major interest groups with a stake in voluntary health insurance.

The argument for private health insurance rests primarily on the presumably greater ability of private management to consider equitably all the interests in question, to design local solutions to local problems, and to combine resilience with toughness, as circumstances require. If health insurance is to be purely a fiscal operation, a mechanism for converting premium dollars into automatic payments to the vendors at whatever price they set, or into simple indemnity payments to the insured, it is

hard to see why the government cannot do it as well and at less expense. Here, it seems, is the real challenge to the survival of voluntary health insurance today. Are the providers of care willing to merge their separate interests sufficiently to permit the development of this type of private leadership and aggressive management?

It is a truism in this country that the government is generally permitted to do only what private enterprise cannot or will not do satisfactorily. The initiative still rests with the voluntary movement. But it may not indefinitely. It is inescapable that public financing, in one form or another, will increase in the medical care field. That the government will continue the trend toward meeting all or part of the costs of certain categories of prolonged illness and certain categories of high-cost, low-income patients is a settled issue.

There are, however, at least two big questions which are far from settled. One involves the future boundaries of public financing; the other, the relationship between public financing and private administration. At this particular juncture of affairs, one would expect the medical profession and the health services industry as a whole to be enormously concerned with strengthening the voluntary institutions, not only to make sure that they can discharge their own responsibilities effectively, but in order to enable them to play a responsible role in the administration of the new public programs.

This cannot be accomplished without responsible, community-conscious leadership and strong management. It also calls for determined support from the majority of the providers and consumers of medical care. The ability of voluntary health insurance to meet successfully the challenge of the "3 C's"—coverage, costs, and controls—and hence insure its own survival, will probably be determined as much by the leaders of the medical profession and other health services as by the plans and carriers themselves.

NOTE: Since this paper was written, the two Blue Cross disputes have been at least temporarily resolved. A fact-finding committee of the American Hospital Association recommended that the Philadelphia reimbursement contract be based on the "full and equitable audited cost of each individual hospital." Reluctantly, the plan agreed "in principle" and the new contract is being hammered out with the 37 hospitals involved. In late September Blue Cross and the eight Catholic institutions reached a compromise settlement calling for reimbursement to the hospitals on the basis of uniform charges, agreed to among themselves, thus avoiding Blue Cross or other external audit. However, they accepted a ceiling, $24 per patient-day until December 31, 1961, guaranteeing that they will not receive more than Blue Cross pays to other hospitals of like size and character.

REFERENCES

(1) Health Information Foundation: Progress in health services. April 1960, p. 1.

(2) Anderson, O. W., and Sheatsley, P. B.: Comprehensive medical insurance. A study of costs, use, and attitudes under two plans. Research Series 9, 1959. New York, Health Information Foundation, 1959, 105 pp.

(3) Bishop, J. E., and Born, R.: Dental insurance. Wall Street J., Jan. 13, 1960, pp. 1, 21.

(4) Somers, H. M., and Somers, A. R.: Doctors, patients, and third parties. Washington, D.C., Brookings Institution, 1961. (In press.)

(5) Brewster, A. W.: Voluntary health insurance and medical care expenditures, 1948–58. Social Security Bull. 22: 4,8 (1959).

(6) Densen, P. M., Balamuth, E., and Shapiro, S.: Prepaid medical care and hospital utilization. Monograph Series No. 3. Chicago, American Hospital Association, 1958, p. 34.

(7) Van Steenwyk, E. A.: Statement before insurance commissioner of Pennsylvania. Exhibit I. January 1958, p. 12.

(8) Draper, W. F.: The medical care program of the United Mine Workers of America welfare and retirement fund. Address to New England Hospital Assembly, March 1958.

(9) Smith, F. R.: Adjudication in re filing of the Associated Hospital Service of Philadelphia, Commonwealth of Pennsylvania, April 1958.

(10) Philadelphia Evening Bulletin, Feb. 12, 1960.

(11) Hosford, R. F.: The future of prepayment plans for hospital care. August 1959, p. 4. (Mimeographed.)

Program Notes

Prepay Pharmacy

In San Jose, Calif., the bricklayers' union with 600 members is participating in a test run of group insurance for prescription drug costs, along with local members of the California Pharmaceutical Association, representing retail druggists, and the Pacific National Life Assurance Company of San Francisco. Encouragement and unofficial cooperation have come from members of the Santa Clara County Medical Society. Premium for the coverage is $1 monthly per family, paid by the union's health and welfare fund to the insurance company. Prescriptions are filled at a participating pharmacy which sends a copy of the prescription and bill, at the going retail rate, to Prescription Service, Inc. This service checks the legitimacy of the claim, and forwards approved bills to the insurance company which pays the druggist directly.

Self-Care Patients

A do-it-yourself wing, with cutrate prices, has been established at the Overlook Hospital in Summit, N.J., for patients able to care for themselves. The patients, who pay half of the regular $20 to $28 daily hospital charge, wear street clothes, eat in the hospital cafeteria, and visit nurses' stations for medication. Two nurses attend the patients in this wing, instead of the five nurses who usually attend a comparable area.

Nonprofit Drug Stores

Plans of nine New York City unions to set up a chain of nonprofit cutrate drug stores for their 900,000 members and families are opposed by six associations speaking for 3,400 retail druggists and by the Drug and Hospital Employees Union representing their registered pharmacists and clerks. The New York Retail Druggists Association claims that the manufacturers' profit after taxes ran from 6.5 percent to 16.8 percent compared with 2.8 percent for retailers. Unions could lower drug prices more effectively by investing in their own drug factory, advised Leon J. Davis, president of Local 1199, Drug and Hospital Employees Union. The pharmacists asked Mayor Wagner to form a permanent pharmaceutical service committee to explore ways of lowering drug costs without putting retailers out of business. The Nassau Physicians Guild questioned the quality of the drugs that would be provided in the union nonprofit drug stores. A board made up of professors of pharmacology would supervise quality standards of the union drug stores.

Alcohol and Ataraxics

A combination of a small amount of alcohol and of the tranquilizer meprobamate can make a person too intoxicated to be a safe driver, according to a report in the August 20, 1960, issue of the *Journal of the American Medical Association.*

Lead in Paint

Chicago health authorities plan to recommend passage of an amendment to the Illinois hazardous substance act which would require that paint containing more than 1 percent of lead be so labeled.

Homemaker Services

A task force created by participants of the 1960 Conference on Personal Care in Homemaker Services underscored as personal services a homemaker might perform:

- Helping the patient with bath, care of mouth, skin, and hair, and helping him to bathroom or in using bedpan.
- Helping him in and out of bed, in learning to walk with crutches, and with prescribed exercises.
- Assisting him to regain his speech, relearn household skills, and with eating.
- Preparing a special diet for the patient.
- Applying heating pad or hot water bottle.
- Giving prescribed medicines.
- Giving hypodermics, under some circumstances and if there is no alternative.

Fluoridation Report

Tooth decay among 6-year-old Baltimore school children has decreased 75 percent since 1955, according to a report by Dr. Huntington Williams, Baltimore health commissioner. Dr. Williams attributes this decrease to the fluoridation of the city water supply beginning in 1952.

Benny Traffic Hit

Since the Food and Drug Administration began its drive to curb illegal sales of amphetamine drugs (bennies) to truck drivers and motorists in the fall of 1959, 85 criminal prosecutions have been completed, 31 additional criminal prosecutions have been instituted and are now pending in Federal district courts, and in eight separate actions 1,837,000 tablets and capsules of amphetamine drugs were seized.

Education for the Retarded

The Connecticut State Legislature in 1959 made mandatory public education for both trainable and educable retarded children. It also created an office of mental retardation within the Connecticut State Department of Health.

Nursing School Admissions

Schools of professional and practical nursing admitted an estimated 71,297 new students in 1959, compared with 68,851 in 1958, according to the National League for Nursing.

Ohio Legislation

The Ohio State Legislature in 1959 gave the Ohio Department of Health authority to form a radiation advisory council and to adopt regulations for radiation, prohibited the sale or delivery for sale of any misbranded package of a hazardous substance, and granted funds to enable the division of industrial hygiene to conduct atmospheric research.

Service Requirements in Dental Prepayment

predictability and adverse selection

QUENTIN M. SMITH, D.D.S., and ELLIOTT H. PENNELL

WITH the surge of interest in prepayment dental care plans, a concomitant interest has developed in predicting probable future demands for dental services by consumer groups under different arrangements for providing care. This interest arises from the necessity for establishing premiums which are sufficiently great to sustain a program and at the same time are low enough to attract prospective subscribers. However, data indicating the extent to which levels or character of service demands may be predicted are generally lacking.

This report is the third of a series based on data from the dental care program of Group Health Association, Inc., Washington, D.C., (*1,2*). It presents the dental care experience of a group of the association's members who were long-term participants in a fee-for-service dental care program operated experimentally so as to simulate a prepayment plan. The analysis demonstrates that even though service demands varied widely within the group, the overall service pattern was generally predictable. Evidence was found, however, that when the care program was offered to the same membership on a true prepayment basis, adverse selection, with serious implications for program costs, did apparently take place.

The Dental Care Program

Group Health Association is a nonprofit membership corporation. It was organized in 1937 in response to demands for a cooperative plan that would provide comprehensive medical and hospital care on a periodic prepayment basis. Services are provided by a professional staff, organized as a group practice, in a clinic owned and operated by the association. From the start, the program has placed special stress upon preventive services and periodic, continuing health care. Throughout the period covered by this study the membership was drawn largely from professional and white-collar workers employed by the Federal Government.

Incorporation of dental care into the association's program was first proposed by a membership committee in 1941. Consideration of the proposal was deferred, however, because of wartime personnel and equipment shortages. In 1945, a dental care committee was appointed by the board of trustees to review operations in existing dental programs and to submit a plan for incorporating dental services within the existing medical care program. In January 1949, dental services were made available to members at a clinic equipped, staffed, and operated by the association. Lack of information concerning the magnitude of service demands that might be encountered in a prepayment dental plan made it necessary to operate the dental clinic on a fee-for-service basis.

From the outset, the dental activity was looked upon as the forerunner of a plan for incorporating dental services into the association's overall prepayment program. With this in mind, members were invited to enroll in a simulated prepayment dental care plan. A

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requirement for enrollment was that the member agree to accept regular and complete dental care as prescribed by the dentists of GHA.

Initial care for each participant in this experimental study group included a thorough diagnostic examination and complete care for dental defects present at the time of the examination. Thereafter, each person was placed under a maintenance care regimen. The participants returned periodically, upon recall, for reexamination and treatment of any dental needs which had accrued since the preceding visit. Although the plan provided for recall at 6-month intervals, scheduling of appointments for reexamination was modified to meet the convenience or special needs of the patient.

In the actual program experience, the average maintenance cycle, comprising the interval of time between recalls, was about 9 months. Within such a maintenance cycle, the work performed presumably reflects the diagnostic and treatment services required to meet all dental care needs which had accrued over the period. The fee schedule first used was based on estimates of the costs involved in providing the various services. Fees were revised from time to time, as experience dictated, to assure balance between operating costs and clinic income.

In April 1956, the association announced the establishment of a prepayment dental plan under which maintenance and preventive dental care would be provided to members who would enroll in family units. Services under the program were to start August 1, 1956, but participation was delayed for enrollees until they had received dental services to meet any accrued needs. Although a sizable segment of the study group joined the new plan, the majority continued their care on a fee-for-service basis.

Method of Study

A review of records maintained by Group Health Association, conducted in the summer of 1957, provided the data for this report. The records identified, by date, the nature of all dental work done and the amount of time required by the dentist, the dental hygienist, or the X-ray technician to perform the service. The complete dental clinic record was obtained from the association's medical record file for each member of the simulated prepayment group, and details of all clinic contacts were abstracted to obtain a complete chronological account of his maintenance care experience at the clinic. Exempted from the data were records on orthodontic service.

During the 8-year period covered by this study, 1949 to 1957, a total of 1,925 persons had participated in the simulated prepayment program. However, since the study is concerned primarily with long-term maintenance patterns, the analysis is restricted to 1,194 persons whose experience in the program continued on a maintenance basis over a period of 4 full years or longer.

Three basic measures were used to reflect utilization of dental care services: clinic visits, chair time, and cost of service. The visit totals were obtained as counts of appointments kept by patients. Summations of time estimates entered upon clinic records were used as measures of chair time. Cost was considered equivalent to value of services given when priced with a mid-period fee schedule supplied by Group Health Association. Use of a single fee schedule permitted the various analyses to be made in terms of constant dollars.

After the data were transcribed, the record for each participant was analyzed to provide annual maintenance care summaries. Maintenance years were defined as successive 12-month intervals between anniversary dates of completion of the individual's initial care.

It should be noted that the amount of service provided an individual in a selected 12-month period may not have served to correct all of the defects which accrued within that year. For example, the first year count of services for an individual who was recalled, reexamined, treated, and discharged again as a completed case 8 months after completion of his initial care reflects only work performed to meet needs which accrued over two-thirds of the year. However, regardless of how well the annual summaries of service requirements may reflect accrued needs, they directly assess demands for service which were met under the program.

For purposes of the comparisons made between joiners and nonjoiners of the prepayment

plan, the data have been weighted to avoid differences which might be accounted for by variations in the distributions of the two groups by age and length of time spent in the simulated prepayment program.

The Experience in Brief

Persons who enrolled in the simulated prepayment program were about equally divided as to sex. In figure 1, it will be observed that the age distribution of the group peaks at 5–9 and again at 35–39. (Refers to age at start of maintenance experience.) This bimodal character of the distribution of the original group was further accentuated by the selection of cases for this report. In the age group under 25 years only half of those who initially entered the program had the 4 years of experience established as the criterion for inclusion in the study group. In contrast, two-thirds of the age group 25–44 years and four-fifths of the group 45 years old and older had the necessary 4 years of experience. Consequently, only a fourth of the persons included in this study were under 25 years of age, more than half were between 25 and 44, and a fifth were 45 years or older. Furthermore, only one in five of those who later were enrolled in the true prepayment plan were under 25, half were in the middle age group, and 30 percent were 45 years or older.

Figure 1. Age distribution of all participants in the simulated dental prepayment program and of the study group

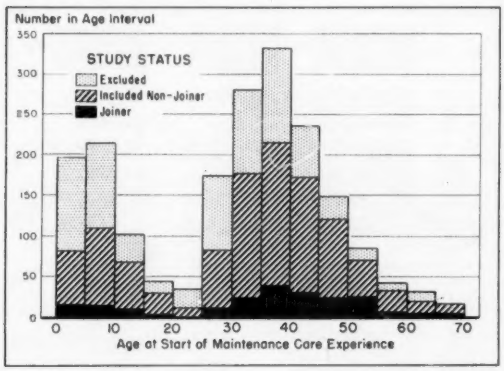
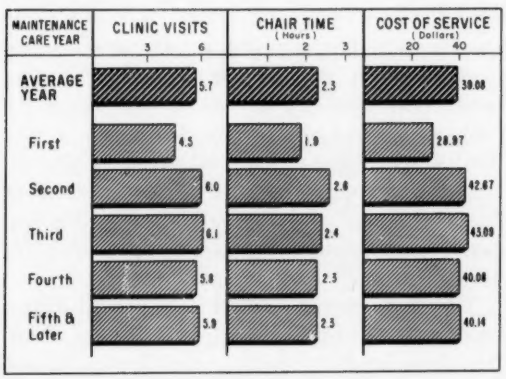


Figure 2. Clinic visits, chair time, and cost of services, per person per year, by maintenance care year



The majority of the persons included in the study were still actively participating in the program at the time of the record review. Within the preceding 9 months, 203 had been enrolled in the association's prepaid plan. The remainder had elected to continue their care on a fee-for-service basis. The data available include 8 full years of maintenance care experience for 54 individuals, 7 years for 247 individuals, 6 years for 328, 5 years for 353, and 4 years for 212. The total person-years of care was 6,742 or 5⅔ years per person in the group studied. The clinic record for the group totaled more than 38,000 visits, nearly 16,000 hours of chair time, and more than a quarter of a million dollars worth of services. Translated to averages, the utilization was equivalent to 5.7 visits, 2.3 hours of chair time, and services costing $39.08 per study participant per year.

Patterns of Service

Data for the different maintenance care years (fig. 2) confirm previous evidence that by three indexes—clinic visits, chair time, and cost of services—demands for dental services by a group under a comprehensive care program change but little from year to year once a maintenance regimen is established. Except for the low first year, the values for the average year closely reflect year-by-year utilization throughout the total experience. The low first-year cost is presumably attributable to the procedure followed in assembling the data. With the record for each individual starting at that point in time when the task of placing his mouth in optimum condition was completed, it is likely

that few if any services were required for a period of several months thereafter. Furthermore, the time of recalls might well have postponed to the following year the correction of some defects which actually developed in the late months of the first year.

After the first year the pattern of predictability in overall service demand levels prevails despite variations in the amounts of different types of services provided the group from year to year and wide variations in the service requirements of individuals and subgroups.

Variation by Type of Service

The impact upon total dental costs of the various types of services provided in the maintenance care program is revealed in figure 3. The average cost of examinations, prophylaxes, and X-rays, which are grouped in the diagnostic category, was $13.34, or more than a third of all expenditures per participant in the average year. The corresponding cost for plastic fillings was $10.86, and $10.02 was paid for inlays, crowns, and bridges. Services in each of these two categories represented more than a fourth of the total. The relatively minor importance of denture work in this program is reflected in cost of only $1.24 per participant. Extractions, denture repairs, periodontal treatment, sodium fluoride applications, and miscellaneous services, which are grouped in the "other" category, averaged $3.62, or about a tenth of the "all service" total.

Although there were no substantial changes from one year to another in the cost of all services given, the average amount paid for different types of services varied significantly (fig. 3). When the services in the years subsequent to the atypical first year are compared, several shifts in cost are noted. There was a tendency for diagnostic costs and costs of miscellaneous services (the "other" category) to expand somewhat and in an orderly fashion. There was also a substantial increase in the average cost of inlays, crowns, and bridges between the second and third years, but this cost was gradually reduced, returning to the second year level during the fifth and later years. A shift to lower values for plastic fillings was apparent for each year succeeding the second. This was also true for denture costs, but the

Figure 3. Annual per person costs of different types of services, by maintenance care year

(Dollars)

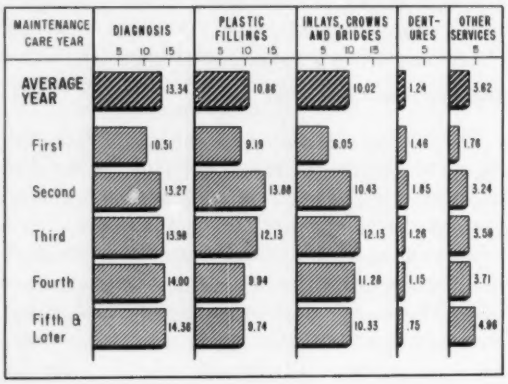
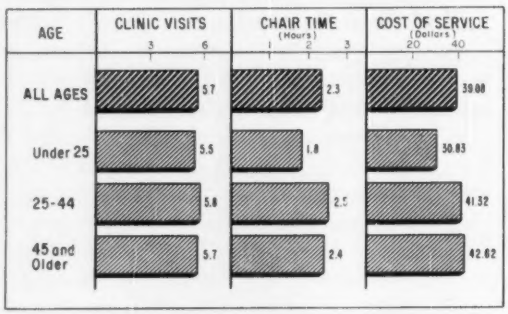


Figure 4. Clinic visits, chair time, and cost of services, per person, by age group



demand for such appliances was so small as to have relatively little impact upon the total cost for all services.

Variation by Age

It will be recalled, from data presented in figure 1, that study participants were rarely over 65 years of age and relatively few were in the 15- to 24-year age group. It has therefore seemed appropriate to refer to findings for persons under 25 years of age as summaries for children, even though data for a few young adults enter into the material. Similarly, findings for persons 45 years of age and older may be referred to as "other adults" with the understanding that they essentially pertain to older persons of working age.

The three indexes reveal only trivial differences in the overall extent to which clinic facilities were used by adults under 45 years of age

and by other adults (fig. 4). Patterns for children were substantially different, however. Although the frequency of visits by children was only slightly less than the frequency of visits by adults, the time required to diagnose and correct the defects presented and the dollar value of services provided each year were substantially less.

Distinctive patterns by age are much more apparent when values are distributed over categories of service (fig. 5). Even the cost of diagnostic services declined slightly with advancing age. The average cost of plastic fillings was sharply reduced from $13.43 for children to $7.87 for adults in the older age group. The cost of inlays, crowns, and bridges, which was only $1.22 for children, was about 10 times this amount for each of the adult groups. No dentures were placed for children; the cost of these appliances was $0.86 per year for young adults and reached $3.54 for those 45 years of age and older. Finally, the miscellaneous group of services expanded from a value of $2.48 per year for children to $5.08 for the older adults.

Figure 5. Annual per person costs of different types of services, by age group

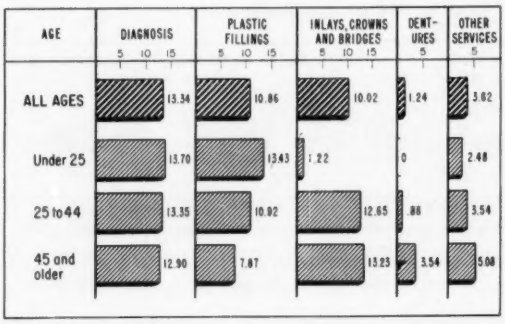
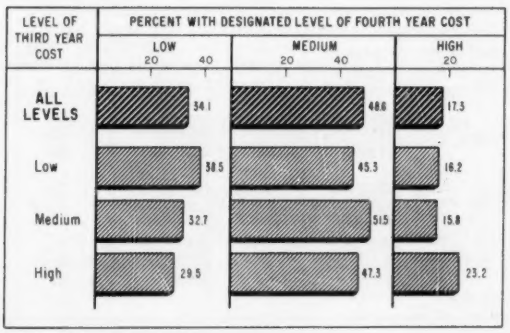


Figure 6. Distribution of persons with low, medium, and high levels of service cost in the third year, by level of cost in the fourth year



Individual Variations

Average costs of the services provided to members of the study group conceal a wide range of costs to different individuals within the group. In spite of periodic recalls and the stated requirement that needed work be completed at periodic intervals, there were numerous instances in each maintenance care year in which individuals failed to make a single clinic visit. At the other extreme, the work performed for a few individuals involved costs amounting to several hundred dollars.

In the average year, services for a third of the group cost less than $20; for nearly half, the cost was between $20 and $59; while for the remaining sixth the cost was $60 or more. For convenience of reference, the individuals classified within these cost ranges are referred to hereafter as having received services at low, medium, and high cost levels, respectively.

Predictability of Costs

The general predictability of dental service costs for the study group is a function of counterbalancing shifts from year to year in individual service demand levels and in no way reflects constancy in these levels. Not only did the cost of services vary widely between individuals in each maintenance care year, but changes in the level of cost from one year to the next characterized service patterns for a majority of the study participants. The general tendency, however, was for shifting away from the divergent and toward the cost distribution of the total group.

To illustrate, in figure 6 the 1,194 study participants are distributed so as to contrast their service costs in the third, or base, year and in the fourth year. (These are the final 2 years of experience for which data are available for all study participants). The similarity observed for the third year high, medium, and low cost groups with respect to their fourth year distributions is remarkable, considering

the changes in service costs which took place from year to year for individuals. Persons grouped at each cost level for the third year are thoroughly redistributed in the fourth in a manner closely resembling the distribution of the total group.

Even more striking is the impact of changing cost patterns upon average costs (fig. 7). Third year costs for the low, medium, and high groups had averaged $9.33, $34.85, and $124.95, respectively. However, changes in costs for individual members of each group during the fourth year so balanced the picture as to bring average costs for all three groups surprisingly close to the fourth year average of $40 for the total study group.

Evidence of Selectivity

Use of services in terms of visits, treatment time, and cost was substantially greater for those persons who subsequently joined the prepayment plan than for others in the study (fig. 8). Throughout the total span of maintenance experience, the average number of visits per year was 6.5 for those who joined the plan and 5.5 for others. Correspondingly, the chair time required was 2.8 hours in contrast with 2.2, and the value of services given per year was $47.22 as compared with $37.22. The trends with succeeding maintenance years for both groups closely paralleled the experience previously discussed for the group as a whole. In every maintenance year, the time and service demands of the joiners were greater than those of the nonjoiners.

Data in figure 9 suggest that the higher overall average values for the joiners of the plan extended to all areas except denture work and the miscellaneous services grouped as "other." Their diagnostic services cost $14.92 per year, plastic fillings, $13.72, and their inlays, crowns, and bridges, $14.34 per year as contrasted with corresponding services costing $12.98, $10.21, and $9.04 for nonjoiners. Conversely, the average costs for dentures and for other services were respectively $0.85 and $3.39 for plan joiners as compared with $1.32 and $3.67 for the remainder of the group. The largest share of added costs for joiners was reflected in their greater utilization of inlays, crowns, and bridges. The greater annual cost for these items alone, $5.30, represents more than half of the overall difference in cost for the two groups. Even the increased use of plastic fillings and of diagnostic services for

Figure 7. Average third and fourth year costs per person, by level of third year cost

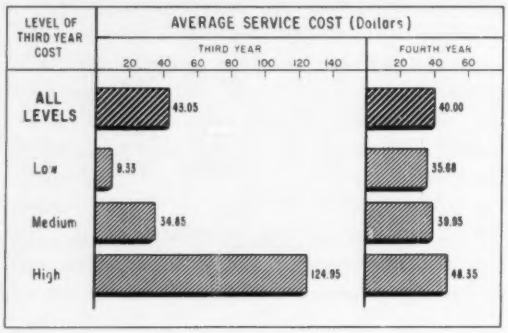


Figure 8. Clinic visits, chair time, and cost of services, per person per year, by participation in the prepayment plan

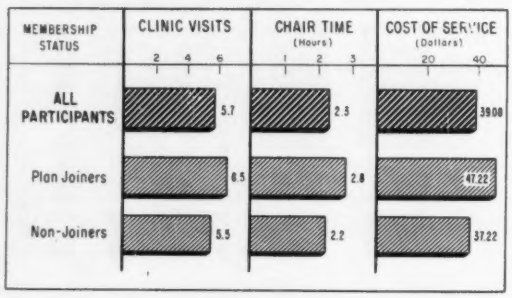
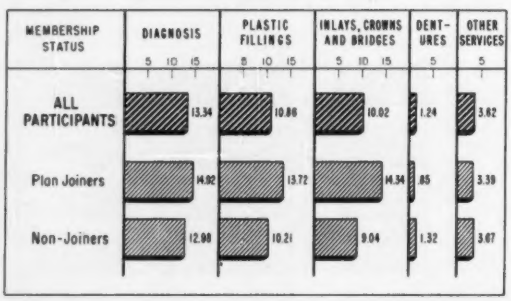


Figure 9. Annual per person costs of different types of services, by participation in the prepayment plan

(Dollars)

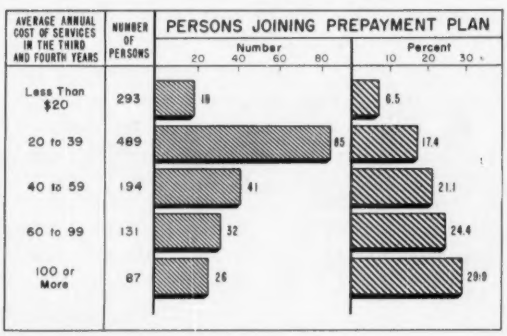


the group of joiners represents added costs ($3.51 and $1.94, respectively) which were relatively large as compared with the small savings attributable to lesser use of dentures and other services.

Selectivity in enrollment is clearly apparent when the proportions joining the prepayment plan are compared for individuals with differing average maintenance costs (fig. 10). Again looking at the third and fourth years of enrollment, the lowest percentage (6.5) of joiners was found in the subgroup whose costs for these years had averaged less than $20 annually. Conversely, the highest percentage (29.9) was among those individuals in the subgroup whose costs averaged $100 or more. The grading of individuals between those with low to those with high costs reflects expanding proportionate enrollment with each step to higher cost levels. On the other hand, it is significant to note that the greatest number of plan joiners was drawn from the group at the $20–$39 level.

This evidence of selection is really only presumptive evidence that the subsequent annual per person costs of providing service to the group electing the prepayment plan actually would be greater than the annual per person cost had been for the total group participating in the simulated plan. It is significant, however, that since the time the data were collected for this study the actual costs of services to the prepayment group have been substantially greater than had been anticipated on the basis of experience with the simulated plan. As a result, compensatory changes in the administrative policies and program charges of Group Health Association's dental plan have been necessary.

Figure 10. Plan joiners, by average annual costs for a 2-year period



Summary

This study of services provided in the Group Health Association's dental clinic summarizes the maintenance care experience for 1,194 individuals during the first 8 years of operation of the association's simulated prepayment dental program. The analysis is restricted to data for those individuals whose continuous participation extended over at least 4 full years. The total experience included was equivalent to 6,742 person-years of participation and averaged 5.6 years per person. Among the group studied there were 203 persons who recently had elected to convert their dental care to a prepaid basis.

Of considerable significance in the findings is the further evidence of constancy in overall demand for dental service by a group once a maintenance regimen is established, despite wide variations in the demands of individuals and subgroups. Also of interest are the distinct time trends in broad categories of care. The demand for plastic fillings, for inlays, crowns, and bridges, and for dentures declined with succeeding years of maintenance care, whereas diagnostic and other service demands increased somewhat.

Average demands for service were much lower for children than for adults. Although a sharp downward trend with age was apparent for plastic fillings, the cost of inlays, crowns, and bridges was much higher for both adult groups than for children. Similarly, the cost of dentures and other services increased regularly with increase in age.

Although costs of services to individuals in the study group varied widely in a given year, the data indicate a marked subsequent tendency for the average costs to low, medium, and high users of service to approach a norm. Thus it would be anticipated that over an extended period of time the range of differences in cost between high and low use groups would diminish substantially.

Three measures of utilization showed con-

sistently higher values for persons who had joined the prepayment plan than for nonjoiners. The joiners made one full visit more per year, utilized a half hour more chair time, and received services costing $10 more. Their pattern of service included substantially higher costs for diagnostic services and plastic fillings and for inlays, crowns, and bridges. Given this evidence it is not surprising that the costs of operating the prepayment plan greatly exceeded original expectations.

REFERENCES:

(1) Pelton, W. J., and Pennell, E. H.: Predictability of dental care needs in adults. J. Am. Dent. A. 52: 703–708, June 1956.

(2) Pelton, W. J., et al.: Comprehensive dental care in a group practice. PHS Pub. No. 395. Washington, D.C., U.S. Government Printing Office, 1954.

Current Morbidity Studies

The eighth annual listing of "Sources of Morbidity Data" has recently been released by the Clearinghouse on Current Morbidity Statistics Projects. The clearinghouse was first proposed in 1951 by the Public Health Conference on Records and Statistics. The Division of Public Health Methods, Office of the Surgeon General, Public Health Service, then developed a plan for such a clearinghouse, which was approved by the conference in 1952. Later the support of the Association of State and Territorial Health Officers and the American Medical Association was received.

The clearinghouse was organized to collect and disseminate information concerning studies and surveys of morbidity. It was given two objectives:

1. To provide a systematic method of telling workers in the public health and medical fields where specific data on human morbidity may be obtained.

2. To afford a convenient means whereby those who are planning studies or surveys involving the measurement of illness, disease, injuries, or impairments may get in touch with others who have undertaken similar tasks.

The contributors to the listings submit the information for a project on a morbidity statistics project notice form, which the clearinghouse supplies. Since its inception, a total of 1,015 studies on sickness and disease have been reported. In the current listing, 105 new projects are described. Most States are represented, although there is a concentration of studies in California, Michigan, Pennsylvania, and New York. The majority of the studies reported are conducted by universities.

Included are such projects as:

- A study of the "causes of health" among residents of Philadelphia.
- A longitudinal study of coronary heart disease among employees of the Western Electric Company in Chicago.
- A long-range citywide health survey in Baltimore similar in some respects to the U.S. National Health Survey.
- A study of mental health problems among reservation and nonreservation Potawatomi Indians.
- A study of the development of peptic ulcers among the 1958 and 1959 freshman classes at Yale University.

"Sources of Morbidity Data, Listing Number 8" (PHS Publication No. 802) will be sent without charge to research workers or persons planning public health programs. Tearsheets of the description of each study are kept on hand for persons who are interested in a particular project or in all projects in a particular field. Write to the Clearinghouse on Morbidity Projects, % Division of Public Health Methods, Public Health Service, Washington 25, D.C.

Decline of the Tuberculosis Epidemic in Alaska

GEORGE W. COMSTOCK, M.D., Dr.P.H., and ROBERT N. PHILIP, M.D., M.P.H.

THERE can be little doubt that tuberculosis was epidemic among Alaskan natives during the first half of the present century (*1–4*). Although the pattern of spread will probably never be known, the disease appears to have been introduced by white visitors and immigrants (*5*) and to have followed in their wake as they sailed Alaska's coasts and floated down her rivers. Thus the disease probably came first to the Aleutian Islands, the southern coast, and the southeastern panhandle with the explorers and fur traders some time in the latter part of the 18th century. The search for gold and whales late in the 19th century provided additional opportunities for the introduction of tuberculosis into the interior and along the northwest coast. When the disease arrived in the delta of the Yukon and Kuskokwim Rivers is not known, but it seems likely that the epidemic peak came later in this area than elsewhere in Alaska.

In any event, the first systematic examination of Alaskan natives for tuberculosis, a tuberculin survey conducted from 1948 to 1951, indicated that the tuberculosis problem was most serious along the lower Yukon and Kuskokwim Rivers (*6*). The prevalence of tuberculin reactors among native children, standardized for age, was 32 percent in southeastern Alaska and the Aleutian Islands, 56 percent in the interior and on the northwest coast, and an astounding 75 percent in the Yukon-Kuskokwim delta. In the 1950's, tuberculosis continued to be the major health problem of Alaskan natives and was particularly serious in the delta region. From 1953 to 1956, the average annual tuberculosis mortality rate in that area was 282 per 100,000, and as recently as 1957, 30 percent of adults had X-ray evidence of past or present pulmonary tuberculosis (*7*).

In spite of the severity of the tuberculosis epidemic along the lower Yukon and Kuskokwim Rivers, a situation which has few rivals in medical literature, there is evidence that the disease is at last being brought under control. Not only have tuberculosis mortality and case rates fallen sharply, but even more significant for the future of tuberculosis control, there has been a marked decrease in the risk of acquiring new infections. So dramatic is this reduction that children whose parents were decimated by tuberculosis may well live to see it become a rare disease.

Both authors are with the Bureau of State Services, Public Health Service. Dr. Comstock is chief of epidemiological studies, Tuberculosis Branch, Washington, D.C., and Dr. Philip is chief, epidemiology section, Arctic Health Research Center, Anchorage, Alaska.

Materials and Methods

The Yukon-Kuskokwim delta is a roughly triangular area, with the Yukon River along its northern border, the Kuskokwim River along the southeast, and the Bering Sea on the southwest (fig. 1). About 7,000 Eskimos and fewer than 1,000 whites live in an area of approximately 30,000 square miles, making it the area with the densest population of Alaskan natives. The delta has 41 villages, ranging in size from about 30 to 1,000 persons and located, for the most part, on the banks of the two major

rivers. Estimates of the tuberculosis infection rates were based on three tuberculin surveys in this area.

The first, which was part of a BCG vaccination program conducted by the Alaska Department of Health, took place during the years 1949 to 1951, the midpoint for the delta region being May 1950. The tuberculin tests were administered and measured by trained physicians and nurses. A dose of 0.00002 mg. of PPD-S, representing 1 tuberculin unit (T.U.), was given intracutaneously, and persons who had reactions with 8 mm. or more of induration 48 hours later were classified as positive reactors (*6*).

The second survey was done in April 1957 by nurses from the Tuberculosis Branch, Public Health Service, who had had extensive experience in tuberculin testing programs (*7*). The third survey, in January and April 1960, was carried out by the nursing staff of the Arctic Health Research Center after a period of training supervised by the authors. For the last two surveys, 5-T.U. doses of PPD-S were used. The reactions were carefully measured at 48 hours, and those showing 6 mm. or more of induration were classified as positive.

It is unfortunate that the dosage of tuberculin and the criterion for a positive reaction were not the same for the first as for the last two surveys, and that the reactions for the first survey were not recorded in millimeters of induration. However, on the basis of other studies (*8*) and the frequency distribution of reactions in 1957, it is likely that the proportion of positive reactions in the first survey would have been only slightly greater had the procedures of the later two surveys been used.

Nearly all children living in the selected villages were tested, but the results for non-Eskimo children are excluded from this report. The analysis of the first and third surveys covers an age span of 9 years; the analysis of the second, 9¼ years. Because the second survey was done in April, and only the birth year was recorded, all ages given for the 1957 program are one-fourth of a year greater than stated subsequently.

The villages included in this study were selected without regard to the severity of the tuberculosis problem, although there was a tendency to select the larger villages. Bethel, the largest village and the transportation center for the area, was tested during the first survey. It is not included in the present analysis because in many ways it is not representative of the area. With this one exception, all of the tested villages in the Yukon-Kuskokwim delta are included in this report.

The last two surveys and the analysis of the findings were made possible through the facilities of the Bethel Prophylaxis Study, a co-

Table 1. Distribution of villages by percent of positive tuberculin reactors among Eskimo children for three tuberculin surveys, Yukon-Kuskokwim delta, Alaska

Positive reactions [1] (percent)	Surveys		
	1949–51 (18 villages)	1957 (11 villages)	1960 (13 villages)
0–9			
10–19			3
20–29		1	8
30–39		1	2
40–49		3	
50–59	2	3	
60–69	6	1	
70–79	5	1	
80–89	5		
90 or more		1	

[1] Adjusted to the age distribution of all three survey populations.

Figure 1. Dashed line shows location of Yukon-Kuskokwim delta

Table 2. Age-adjusted percent[1] of positive tuberculin reactors among Eskimo children in villages of Yukon-Kuskokwim delta, Alaska, by participation in three tuberculin surveys

Surveys in which villages were tested	Number of villages	Surveys		
		1949–51 (percent)	1957 (percent)	1960 (percent)
Total	29	71.5	52.2	25.1
All 3	1	81.2	44.5	26.0
1st and 2d	3	74.6	56.0	----
1st and 3d	7	70.2	----	24.5
2d and 3d	1	----	56.2	24.1
1st	7	70.1	----	----
2d	6	----	45.5	----
3d	4	----	----	27.6

[1] Adjusted to the age distribution of all three survey populations.

operative enterprise established in 1957 to study the usefulness of isoniazid in preventing tuberculosis. The study is supported by three branches of the Public Health Service, Division of Indian Health, Arctic Health Research Center, and Tuberculosis Branch, and by the Alaska Department of Health and Welfare.

Results

Of the 40 villages, 18 were tested in the 1949–51 survey, 11 in 1957, and 13 in 1960. Only 1 village was tested in all three surveys, 11 in two surveys, and 17 in one survey, while 11 have not been tested. This is very close to the distribution which would have resulted from chance alone, given the decision to test the stated number of villages in each survey.

The level of tuberculin sensitivity among children showed some variation from village to village in each time period (table 1). This was most marked for the 1957 survey, perhaps because of the inclusion of a number of small villages. In spite of this variation, the downward trend in tuberculin sensitivity is unmistakable.

Further assurance that the decreasing prevalence of tuberculin reactors is not likely to be the result of selection alone is shown in table 2. For all villages, the prevalence of positive reactors was more than 70 percent in 1949–51, about 50 percent for 1957, and 25 percent for 1960. At each of the three periods, the proportion of reactors was similar for villages tested in one, two, or three surveys.

The percentage of positive reactors by age is shown in table 3 and figure 2 for each of the three surveys. In 1949–51, the proportion of infected children increased very rapidly with age, reaching 92 percent in the age group 7–8 years. In 1957, the increase with age was still marked, but much less so. By 1960, there were no reactors less than 1 year of age, and only a few between 1 and 3, but among older children the proportion of positive reactors again increased rapidly with age. The shapes of the three curves in figure 2 suggest that the infec-

Table 3. Prevalence of tuberculin sensitivity among Eskimo children tested in three successive surveys, by age, Yukon-Kuskokwim delta, Alaska

Age group (years)	1949–51			1957			1960		
	Total tested	Positive reactors		Total tested	Positive reactors		Total tested	Positive reactors	
		Number	Percent		Number	Percent		Number	Percent
Under 1	88	12	13.6	46	2	4.3	84	0	0
1–2	168	74	44.0	100	19	19.0	203	5	2.5
3–4	168	132	80.0	96	47	49.0	177	15	8.5
5–6	164	148	90.2	93	69	74.2	200	66	33.0
7–8	159	146	91.8	90	75	83.3	179	123	68.8
0–2	256	86	[1] 34.4	146	21	[1] 14.4	287	5	[1] 1.7

[1] Adjusted to the age distribution of all three survey populations.

tion rate was extremely high during the entire lifetime of individuals tested in 1949–51 and that it had fallen appreciably but was still high among those tested in 1957. For those tested in 1960, it appears that the infection rate in recent years was quite low but had been much higher during the earlier lifetime of the older children.

Because the infection rate was apparently changing rapidly during the period under study, the average rate calculated for the entire 9-year period represented by each of these curves is not very meaningful; in addition, BCG vaccination, done in this area between 1949 and 1956, might have been responsible for some of the reactions in the 1957 and 1960 surveys. To minimize these difficulties, it was decided to utilize only the experience of children less than 3 years of age in estimating the average annual infection rate. The rate over this restricted interval should closely approximate that during the year or so prior to testing. Furthermore, the effect of BCG vaccination is negligible in this age group. Only 10 children had been vaccinated, all of them participants in the 1957 survey.

Figure 2. Prevalence of tuberculin sensitivity among Eskimo children tested in three successive surveys, by age

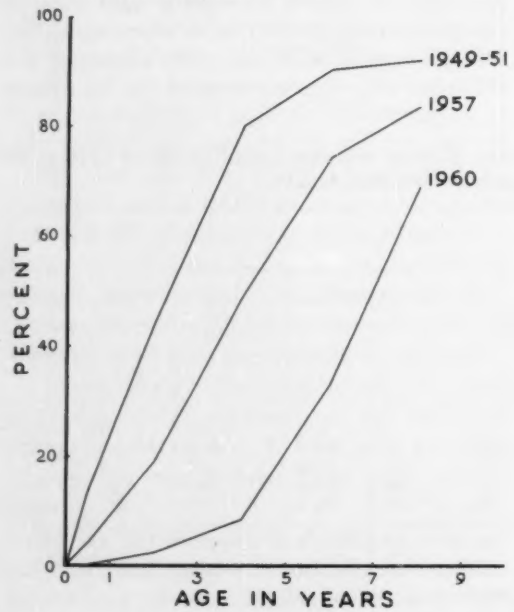


Table 4. Average annual tuberculosis infection rates among Eskimo children 0–3 years of age, in three successive periods, Yukon-Kuskokwim delta, Alaska

Survey	Positive reactors (percent)	Average annual infection rate [1] (percent)
1949–51	34.4	24.6
1957	14.4	8.5
1960	1.7	1.1

[1] During the 3-year period prior to each survey.

The average annual infection rates estimated in this way from each survey are shown in table 4. For the 3-year period prior to testing in 1949–51, 24.6 percent of the negative reactors would have had to be infected each year to yield a prevalence ratio of 34.4 percent in the age group 0–3 years. Prior to the 1957 survey, the average annual infection rate was 8.5 percent, while prior to the 1960 survey it was only 1.1 percent. The dramatic decrease in the risk of acquiring new infection is illustrated in figure 3, which shows a much greater rate of decline between 1957 and 1960 than between 1950 and 1957. Further assurance that the most recent estimate is not too optimistic is the fact that a tuberculin survey of two villages in 1959 yields an estimated infection rate that falls below the curve shown in figure 3.

Discussion

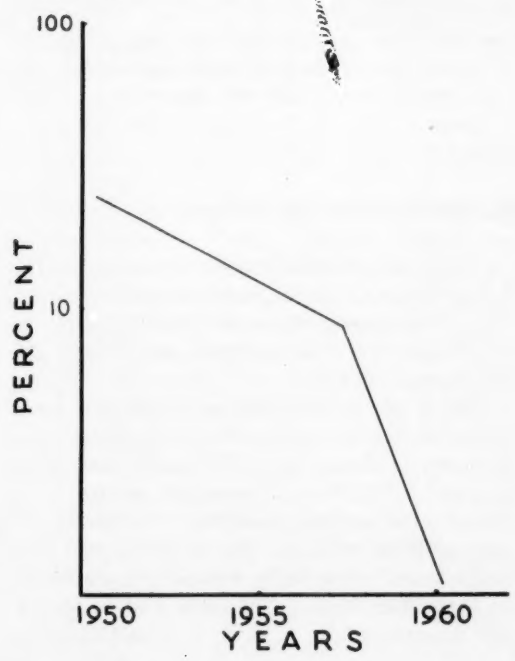
A recent report on public health in Alaska records marked improvement in the tuberculosis problem among Alaskan natives as measured by traditional indices (*9*). The tuberculosis death rate for Aleuts, Eskimos, and Indians was 501 per 100,000 in 1952; in 1959, the provisional rate was 54 (*10*, *11*). At the end of 1955, the year the maximum number of tuberculosis beds was first made available, 1,311 Alaskans were hospitalized for tuberculosis; 3 years later, the number was 444, and there were very few persons at home known to be infectious. Dramatic as these reductions are, the infection rate declined even more sharply in the Yukon-Kuskokwim delta.

There is reason to believe that the infection

rate has also declined markedly in other areas of Alaska suggesting that here, as elsewhere in the United States, the tuberculosis problem is becoming concentrated among those already infected. Preliminary unpublished analysis of an isoniazid prophylaxis study in the Yukon-Kuskokwim delta indicates that tuberculosis in this area, as measured by deaths and active cases, is still further concentrated among persons with a previously diagnosed disease. If the current pressure against tuberculosis through casefinding, treatment, and isolation can be maintained and if known cases continue to be carefully followed, it seems likely that the infection rate will soon approach the low level found in the United States as a whole, recently estimated to be less than 0.1 percent per year (*12*).

This encouraging reduction in the infection rate has occurred in an area of Alaska long considered to have one of the worst tuberculosis problems in the world. Nor was the magnitude of the tuberculosis problem the only handicap encountered when a systematic tuberculosis control program, already in effect in other parts of Alaska, was initiated in the Yukon-Kuskokwim delta only 6 years ago. The estimated 7,000 native inhabitants of the delta live in about 40 villages scattered over an area roughly the size of the State of South Carolina. Personnel, patients, and supplies are usually transported by small bush planes; for shorter trips, dogsleds, snowplanes, and boats are used. But all travel can be and often is delayed by adverse weather conditions. Even now, the bulk of the population lives close to the subsistence level and many adults speak only Eskimo.

Figure 3. Average rate of decline in tuberculosis infection rates among Eskimo children 0–3 years of age in two periods: 1949–57 and 1957–60



Nevertheless, conditions are better than they were 10 years ago, and as a result, the control of tuberculosis has become less difficult. For without the facilities brought by an improved standard of living, without the increased understanding afforded by education, and without the high degree of cooperation of the people in all phases of the tuberculosis control program, it is unlikely that the efforts of public health personnel, dedicated as they have been, could have accomplished so much so quickly.

Some mention of BCG vaccination should also be made, especially since the tuberculin testing of 1949–51 was done as part of a mass vaccination campaign. During the ensuing 5 or 6 years vaccination was continued sporadically. It was then discontinued, largely because it was not possible to produce satisfactory tuberculin conversions under existing conditions. In any event, since only a small proportion of the population was vaccinated, no significant part of the reduction in tuberculosis can be attributed to BCG. Nor does it seem reasonable to anticipate that BCG will play an important role in the future, since its usefulness varies directly with the infection rate (*13*). This rate is already low, and appears to be rapidly diminishing, so that the principal source of future tuberculosis cases will undoubtedly be the persons who are already infected and for whom BCG has nothing to offer.

Because of the likelihood that previously infected persons will provide the tuberculosis cases of tomorrow, controlled cooperative trials of isoniazid prophylaxis have been initiated by the Tuberculosis Branch of the Public Health Service in the hope that a method for reducing

the risk of disease among infected persons may be found. More than 6,000 inhabitants of the Yukon-Kuskokwim delta are participating in these trials. If with their help isoniazid is shown to be an effective prophylactic agent, this finding could signal the end of the tuberculosis epidemic among Alaskan natives.

Summary

Between 1949 and 1960, three tuberculin surveys have been done among the Eskimo population living in the Yukon-Kuskokwim delta of Alaska. The results of tuberculin tests among children less than 3 years of age were utilized to obtain an estimate of the tuberculosis infection rates. In 1949–51, the average annual infection rate was 24.6 percent; in 1957, it was 8.5 percent; and in 1960, it was only 1.1 percent. This dramatic decline appears to have resulted not only from improvements in social and economic conditions but particularly from a vigorous antituberculosis campaign with emphasis on casefinding, isolation, and treatment.

REFERENCES

(1) Fellows, F. S.: Mortality in the native races of the Territory of Alaska, with special reference to tuberculosis. Pub. Health Rep. 49: 289–298, Mar. 2, 1934.

(2) Albrecht, C. E.: Public health in Alaska—United States frontier. Am. J. Pub. Health 42: 694–698, June 1952.

(3) Blomquist, E. T., and Weiss, E. S.: The tuberculosis problem in the Pacific Territories: Alaska. *In* Transactions, National Tuberculosis Association, 49th annual meeting, 1953, pp. 46–49.

(4) Barnett, H. E., Fields, J., Milles, G., Silverstein, J., and Bernstein, A.: Medical conditions in Alaska. J.A.M.A. 135: 500–510, Oct. 25, 1947.

(5) Aronson, J. D.: The history of disease among the natives of Alaska. Tr. & Stud. Coll. Physicians, Philadelphia. 8: 27–34, April 1940.

(6) Weiss, E. S.: Tuberculin sensitivity in Alaska. Pub. Health Rep. 68: 23–27, January 1953.

(7) Comstock, G. W., and Porter, M. E.: Tuberculin sensitivity and tuberculosis among natives of the lower Yukon. Pub. Health Rep. 74: 621–634, July 1959.

(8) Palmer, C. E., and Bates, L. E.: Tuberculin sensitivity of tuberculous patients. Bull. World Health Organ. 7: 171–188 (1952).

(9) Alaska, frontier for health services. Pub. Health Rep. 75: 877–912, October 1960.

(10) Alaska TB report 1952–57. Anchorage, Alaska Department of Health, Division of Tuberculosis Control, 1958.

(11) Alaska Tuberculosis Report, 1959. Anchorage, Alaska Department of Health and Welfare, Division of Health, Section of Tuberculosis, 1960.

(12) U.S. Public Health Service: Tuberculosis chart series. 1959 edition. PHS Pub. No. 639. Washington, D.C., U.S. Government Printing Office, 1959.

(13) Palmer, C. E., Shaw, L. W., and Comstock, G. W.: Community trials of BCG vaccination. Am. Rev. Tuberc. 77: 877–907, June 1958.

Surgeon General Urges Polio Vaccination of Infants

By September 1960, about 93 million people, or 60 percent of the population under 60 years of age, had at least one dose of polio vaccine compared with 85 million people, or 56 percent of the population under 60, in September 1959, according to sample surveys conducted by the Bureau of the Census. About 25 percent had four or more doses in 1960 compared with 14.2 percent in 1959.

Surgeon General Leroy E. Burney of the Public Health Service reports the trend has been the same in each of the 4 years the survey has been conducted.

"People who start their polio shots usually follow through with the recommended doses. This is encouraging because it is the third and fourth doses that give the greatest protection," Dr. Burney said.

"We all should be greatly disturbed, however, that so many babies and preschool children remain unvaccinated. To date, we have analyzed 1,300 paralytic cases that occurred this year and we have found that 597 of them were children under 5. Such tragedies will continue unless we begin, routinely, to start each new baby on his polio shots when he is 2 to 4 months old."

This study is another indication of the need for careful reporting, backed up by epidemiological investigation, as a basis for analyses of accidents that will lead to logical design of control measures. It also suggests the value of further work that will more accurately relate accident experience to exposure and risk.

Epidemiology of Childhood Accidents in Two California Counties

REUEL A. STALLONES, M.D., and LESLIE CORSA, Jr., M.D.

THE SIGNIFICANCE of accidents as a cause of death and disability in childhood has been noted repeatedly in recent years in many parts of the world, and a large number and variety of investigations have been undertaken (*1*). Few of the reported studies, however, allow an assessment of the risk of accident within a definable population. Under these circumstances, comparison of the experience of different communities has been difficult, and quantitative evaluation of the effectiveness of prevention programs has been virtually impossible.

In 1956 the child welfare committee of the Alameda-Contra Costa Medical Association (Alameda and Contra Costa Counties, Calif.) and the bureau of maternal and child health of the California State Department of Public Health, sharing an interest in the problem of accidents among children, initiated a study with these primary objectives: to develop a method of estimating the extent of accidents in the two counties, to gather information on which to base preventive measures, to establish measurements of accidental injuries for use in evaluating prevention programs, and to provide background for more intensive study of specific accidents.

Dr. Stallones is associate professor of public health, University of California School of Public Health, Berkeley. Dr. Corsa is chief of the bureau of maternal and child health, California State Department of Public Health.

Method of Study

Alameda and Contra Costa Counties lie adjacent on the eastern side of San Francisco Bay. The 1957 population, as estimated by the California State Department of Finance, was 1,229,700, of whom about 353,000 were under 15 years of age. Along the eastern shore of San Francisco Bay is a densely populated urban region, composed of San Leandro, Alameda, Oakland, Berkeley, Richmond, and a number of smaller municipalities. The coastal valleys farther east are filled with suburban commuter communities. In the extreme eastern portion of the counties, beyond easy commuting distance, are farms and ranches. Generally, the area is prosperous, and the population is reasonably representative of other urban-suburban complexes in California and elsewhere.

The topography and population distribution in these counties are such that there is relatively little drift outside the counties for emergency medical care. For example, only 5.2 percent of the 1957 resident births of the two counties oc-

curred in other counties, including 2.2 percent in San Francisco, 1.4 percent in Santa Clara, and 0.7 percent in Solano.

The study of accidents was primarily descriptive, designed to determine the frequency of medically attended accidents in a defined child population and to describe their occurrence in time and space. The administrative officers of all 24 hospitals in the two counties (excluding the federally supported institutions) were contacted, and 23 agreed to cooperate by submitting reports on children under the age of 15 years admitted to the emergency rooms for treatment of an accidental injury. The report card was brief, giving the name, address, age and sex of the child, type of accident, and type of injury. The single hospital not included in this study was small and, we believe, represents a loss of less than 1 percent. The reporting system has been described in more detail elsewhere (*2*).

Preliminary reporting began on July 1, 1956, but complete reporting and analysis did not start until January 1, 1957, when the reporting system was adopted as a continuing function. The main part of this report covers the calendar year 1957; preliminary tabulations of data collected for 1958 are also presented. The analyses were based on a count of separate admissions, not an unduplicated count of individuals. When multiple injuries were reported for a single accident, the case was classified according to the most serious injury, insofar as this could be judged.

In addition to the hospital reports, a survey of accidental injuries seen in physicians' offices was conducted October 14–27, 1957, and again August 11–24, 1958. All physicians likely to treat children were sent copies of a roster form on which to record a few items of information about each case seen during the 2-week periods.

All Accidents

A total of 27,623 accidents in children less than 15 years of age were reported for 1957 from the emergency services of the hospitals of Alameda and Contra Costa Counties for an overall attack rate of 78.2 per 1,000 children per year. These cases were classified by type of accident and by type of injury, and the data are presented in table 1. Since an injury may be cared for at home, treated in a physician's office, or referred or admitted directly to a hospital, the relative frequency of various types of accidents and injuries cannot be presumed to be reflected in these data taken only from the hospital emergency room reports, for certain types are more likely than others to come to the attention of these facilities because of various social, medical, and legal implications.

Well over half the reported injuries were minor as judged by the diagnosis. Another

Table 1. All childhood accidents reported by hospitals, by type of accident and by type of injury, Alameda and Contra Costa Counties, Calif., 1957

Type of accident	Type of injury									
	Contusion or abrasion	Laceration	Sprain or strain	Fracture	Head injury	Burn	Poisoning	Other and not stated	Total	Percent of total
Automobile accident	657	222	35	122	114	0	0	390	1, 540	5. 6
Fall	1, 291	4, 096	832	1, 385	529	50	0	939	9, 122	33. 0
Caught in device or object	736	466	26	83	1	3	0	145	1, 460	5. 3
Hit by object	753	2, 818	181	216	181	404	4	582	5, 139	18. 6
Stepped on object	69	425	4	0	0	30	0	912	1, 440	5. 2
Fire or explosion	2	4	1	1	1	56	0	7	72	0. 3
Firearms	2	1	0	1	1	3	0	20	28	0. 1
Ingestion	0	8	0	0	0	0	2, 109	509	2, 626	9. 5
Strangling or suffocation	0	1	0	1	0	0	1	18	21	0. 1
Other and not stated	792	2, 031	272	241	53	235	22	2, 529	6, 175	22. 4
Total	4, 302	10, 072	1, 351	2, 050	880	781	2, 136	6, 051	27, 623	100. 0
Percent of total	15. 6	36. 5	4. 9	7. 4	3. 2	2. 8	7. 7	21. 9	100. 0	

Table 2. All childhood accidents reported by hospitals, by age and sex, with attack rates per 1,000 population, Alameda and Contra Costa Counties, Calif., 1957

Age (years)	Males			Females			Both sexes			Ratio of male to female attack rates
	Estimated population [1]	Cases	Attack rate	Estimated population [1]	Cases	Attack rate	Estimated population [1]	Cases [2]	Attack rate	
Under 1	13, 654	396	29. 0	13, 172	319	24. 2	26, 826	719	26. 8	1. 20
1	13, 356	1, 342	100. 5	12, 936	973	75. 2	26, 292	2, 331	88. 7	1. 34
2	13, 447	2, 263	168. 3	13, 128	1, 530	116. 5	26, 575	3, 826	144. 0	1. 44
3	13, 527	1, 744	128. 9	13, 259	1, 166	87. 9	26, 786	2, 947	110. 0	1. 47
4	13, 561	1, 488	109. 7	12, 977	939	72. 4	26, 538	2, 461	92. 7	1. 52
5–9	62, 671	5, 613	89. 6	60, 941	3, 102	50. 9	123, 612	8, 813	71. 3	1. 76
10–14	49, 351	4, 135	83. 8	47, 227	2, 004	42. 4	96, 578	6, 210	64. 3	1. 98
Not stated		204			77			316		
Total	179, 567	17, 185	95. 7	173, 640	10, 110	58. 2	353, 207	27, 623	78. 2	1. 64

[1] Estimates for midyear 1957.
[2] Includes those with sex not stated.

indication that most of the injuries were not serious was the small proportion of cases admitted to inpatient services following the emergency room visit. Of the 27,623 cases, only 1,256 (4 percent) were admitted to inpatient services for treatment or further observation.

To estimate the total load of childhood accidents on the medical facilities of the community, patients treated in physicians' offices must be added to the hospital group. During the 2-week period in 1957, 318 physicians (38 percent of 832 asked to report) recorded 530 visits. Of these 530, 89 were also reported to us by a hospital. On the basis of these incomplete returns, we estimate that 1,000 to 1,100 cases were seen in physicians' offices during the 2-week survey in addition to those reported by the hospitals. During this same 2-week period 973 cases were reported by the hospitals. From these figures, we estimate that the total number of medically attended accidental injuries for 1957 was 50,000 to 55,000 for an incidence rate of roughly 150 cases per 1,000 children per year.

Table 3. All reported childhood accidents, by day of week, Alameda and Contra Costa Counties, Calif., 1957

Day of week	Hospital reports		Physicians' reports [1]	
	Total number accidents	Average cases per day	Total number accidents	Average cases per day
Monday	3, 703	71	108	54
Tuesday	3, 539	67	93	47
Wednesday	3, 513	68	66	33
Thursday	3, 638	70	74	37
Friday	3, 496	67	82	41
Saturday	4, 617	89	50	25
Sunday	4, 880	94	57	29
Not stated	237		0	
Total	27, 623	76	530	38

[1] 2-week period.

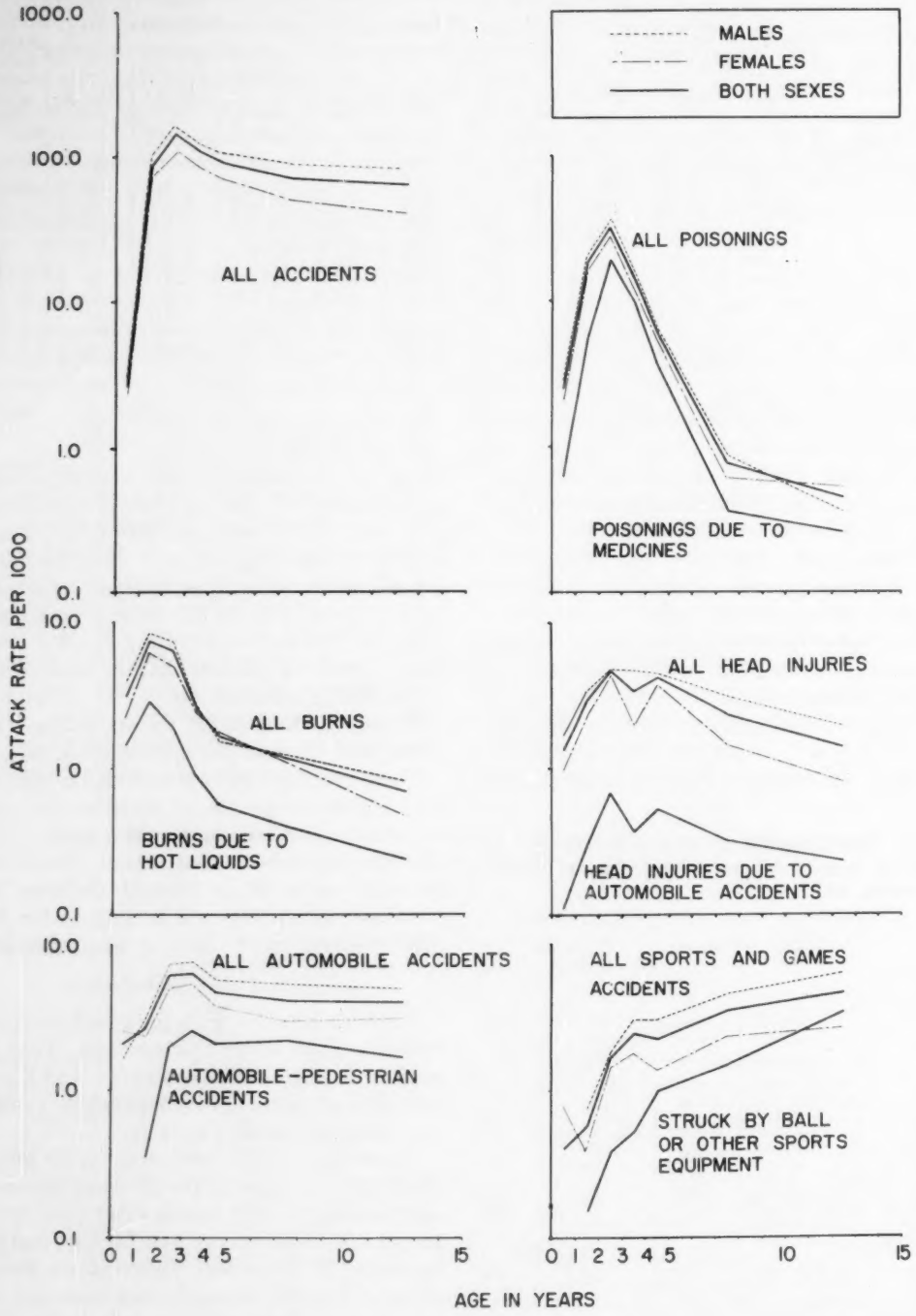
The physicians' reports included a considerably higher proportion of accidents occurring at school than the hospitals' reports. This confirms an opinion that school officials customarily refer ill or injured children to a particular practitioner, according to the families' requests, rather than to an institution.

Age and Sex Distribution

For both boys and girls the attack rates were lowest in those under 1 year of age. They rose rapidly to a peak between ages 2 and 3 years and declined thereafter throughout the age span covered in this study (table 2).

There were 17,185 boys and 10,110 girls in the 27,623 case reports (for 328 cases the sex was not recorded). The attack rates were 96 and 58 per 1,000 children per year for boys and girls respectively. Boys had higher attack rates at all ages, but the preponderance increased with age from a slight excess in infancy to almost

Age- and sex-specific attack rates for childhood accidents reported by hospitals, Alameda and Contra Costa Counties, Calif., 1957



double the rate for girls among the 10- to 14-year olds (table 2).

Distributions by Season and Day

Since the population during this period was relatively constant, the average number of cases per day for each month can be treated as a rate. The curve described by these statistics had its lowest point in January with 50 cases per day, rose steadily to a peak of 102 per day in June, and then fell during the latter half of the year to 53 per day in December.

The cases seen in hospitals tended to occur more frequently on Saturdays and Sundays than on other days of the week, but there was no consistent pattern of high and low for the weekdays; conversely, the frequency of cases reported by private physicians was low on Saturdays and Sundays (table 3). If, as we believe, the cases reported to us by physicians represented almost half the actual number treated, then the Saturday-Sunday excess of cases reported by the hospitals just about balanced the deficit in the physicians' reports.

Selected Accidents and Injuries

For the cases reported by the hospitals in 1957, three specific types of injury and two specific types of accidents were selected for detailed analysis.

Poisoning

The hospitals reported 2,136 cases of accidental poisoning in 1957 (8 percent of the total accidents). Fifty-three percent were the result of ingestion of medicines, and 15 percent involved ingestion of insecticides. Seven percent of the cases were admitted to the inpatient services of the hospitals, a proportion similar to that for burns.

The age of greatest risk was between 2 and 3 years for both boys and girls (see chart). The curve rose steeply and fell sharply so that about four-fifths of the cases occurred in children under 4 years of age. The risk was similar for boys and girls, with boys showing a slight preponderance over girls except in the age groups under 1 and 10–14 years. The age curve for poisonings reached a peak about a year later than that for burns. Also interesting was the finding that the risk of ingesting insecticides reached a peak earlier and fell more rapidly than the risk for medicines. This difference suggests that unpleasant experiences of touch and taste (and perhaps odor) are important in the development of avoidance reactions and thereby decrease the likelihood of accidental injury.

There was a significant seasonal swing for all poisonings combined, but the pattern differed for different substances. Ingestion of medicines and other miscellaneous substances was most frequent in the autumn, whereas poisoning with insecticides showed a marked excess in summer over winter. The summer increase in insecticide poisonings is undoubtedly related to the availability of these materials, but the reason for the seasonal variation in poisonings attributed to medicaments is not apparent.

The distribution by day of week showed that cases of medicine ingestion were relatively more frequent during midweek than on the weekend, while cases of insecticide ingestion had a reverse pattern. These findings may well be related to the availability of the materials and the variation in family activities.

Burns

A total of 781 cases were reported as burns (3 percent of the total accidents reported). Of these, 36 percent resulted from contact with a hot liquid, 7 percent from fire or explosion, and the remainder, 57 percent, from striking or falling against a hot object or in some manner not specified.

Seven percent of these cases were admitted to the inpatient services of the hospitals. For burns due to open fire or explosion, however, 29 percent were admitted (but this percentage is based on a small number of cases).

The highest incidence was for children between 1 and 2 years old, a younger age than for most other accidents (see chart), and thereafter the frequency decreased, rapidly at first, then more slowly. The same general pattern held for both sexes and for each of the categories. There were, however, some differences between the sexes. For burns of all types together, the risk for boys exceeded that for girls at all ages, except for a very slight preponderance among girls at age 4. For burns attrib-

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uted to contact with hot liquids, boys suffered a higher attack rate up to age 4, but thereafter girls had the higher rates.

No significant differences were observed by season of the year for any of the types of burns recorded. The absence of a seasonal variation for burns caused by household heating devices is attributed to the benign and equable climate in the region surrounding San Francisco Bay.

Burns tended to occur more frequently at the beginning and end of the week. The difference is greater than would be expected by chance when tested against the hypothesis that all days should be equal ($X^2=16.9$; $P\approx0.01$).

Six hundred and ninety-eight (89 percent) of the reported cases occurred at home. Of these, 44 percent occurred in the kitchen; by far the majority of the remainder were reported as having occurred in some unspecified location in the home. For burns due to hot liquids, 66 percent were said to have occurred in the kitchen. Thus, the places of occurrence seem to reflect accurately the relative risk of exposure to fire and hot liquids.

Head Injuries

Head injuries are of special interest because of their potential seriousness. In this series, 20 percent of the cases were admitted to the hospital inpatient services as compared with 7 percent of the burns, 7 percent of the poisonings, and 4 percent of all accidents reported.

Of 880 head injuries, 60 percent were due to falls, 21 percent resulted from being struck by an object, and 13 percent occurred in automobile accidents.

Boys had 562 (64 percent) of the head injuries for an attack rate of 3.13 per 1,000 compared with 1.77 per 1,000 for girls. More boys than girls suffered head injuries at all ages, and in the age group 10–14 years, the ratio was about 2.5 to 1 (see chart). The only exception to the preponderance among boys was for injuries incurred in falls by children aged 2 years: the rate for girls was 3.35 per 1,000 compared with a rate for boys of 2.75 per 1,000.

For both sexes, the age of highest risk was 2 years, although the attack rate did not decline as sharply as for burns and poisonings, remaining relatively high through 4 years of age.

The seasonal distribution was somewhat irregular, but the rates were higher from March through August than during the late fall and winter. Head injuries in automobile accidents peaked in March, April, and May; the peak months for those due to being struck by an object were March through July; and head injuries incurred in falls were most frequent in June, July, and August.

The usual Saturday and Sunday excess was noted, although this was most evident in the categories of automobile accidents and falls and not at all consistent in the group injured by contact with objects.

Except for those incurred in automobile accidents, most of the head injuries occurred at home, mainly in the yard.

An interesting consideration with respect to head injuries is their relationship to the physical development of children. This may be seen by comparing the age variation in the proportion of head injuries resulting from a specific kind of accident. For example, automobile accidents occurred with an overall frequency of 4.36 per 1,000 children, while head injuries due to automobile accidents had a frequency of 0.32 per 1,000. But the proportion of automobile accidents which resulted in head injuries varied with age, being highest at age 2 and lowest in infancy and in the upper ages in the study, indicating an age specificity for head injuries, independent of the age distribution of automobile accidents.

Automobile Accidents

The hospitals reported 1,540 injuries due to automobile accidents, characterized as collisions, automobile-pedestrian accidents, and all other automobile accidents. The accidents in which the child was a pedestrian tended to be more severe than those in which the child was a passenger, as evidenced by the higher proportion of the cases which resulted in fractures and head injuries. Of the 640 automobile-pedestrian cases, 144 (22 percent) were admitted to the hospital, whereas of the remaining 900 cases, only 80 (9 percent) required hospital care.

Boys experienced a somewhat greater risk of automobile accidents than girls, 5.17 cases per 1,000 compared with 3.36 cases per 1,000. This

difference was largely attributable to accidents involving pedestrians, in which boys exceeded girls by a ratio of 2.2 to 1. It may be assumed that the propensity of boys to engage in more active games than girls, perhaps playing in the street more often, is reflected in their higher rates. For collisions there was virtually no difference between sexes. The male preponderance varied by age, and again this effect was produced primarily by the automobile-pedestrian category.

Automobile accidents were not nearly as age selective as burns or poisonings (see chart). The risk was low in infancy, but increased rapidly and remained high thereafter.

Automobile accidents tended to accumulate on weekends, especially for the category of collisions, and in the spring and summer. Collisions contributed heavily to the summer peak, and pedestrian accidents to the spring and summer incidence.

In some sections of the country, hazardous driving conditions in the winter months apparently cause an accumulation of automobile accidents in that season. However, here the climate appears to operate in a different way, increasing the risk of injury during weather which attracts our wandering population to the open road. This increased exposure to risk surely operates on weekends and during summer vacation from school when there are more cars and more children competing for the same amount of space on the streets.

Playground and Games Accidents

During the survey, 1,060 accidents were reported to have occurred in games and sports activities; 494 were due to falls from playground equipment, and 566 were due to being struck by balls or other sports equipment.

As would be expected, the risk of an accident in this category increased with age, being rare in the infant and the preschool child. There was a definite difference between the two categories; falls increased more rapidly to age 3 and tended to decrease in the older ages, while injuries from sports equipment rose more slowly but continued to increase throughout the age span studied. Boys were more frequently hurt than girls, with an attack rate of 3.91 per 1,000 compared with 1.94 per 1,000 (see chart).

This group of accidents holds particular promise for further study. Since a major share occur at school, they are relatively well documented. Moreover, if the study is limited to school children, the accident cases can be related to a definite population from which they came, and for this population group many social, economic, physical, and mental characteristics are already recorded.

Preliminary Data for 1958

During 1958, 28,622 accidents were reported by the hospital emergency rooms, an increase of 999 over 1957. The distributions of the cases by type of accident and type of injury were remarkably similar to those for the 1957 cases (table 4). The age distributions were also very similar (table 5). The occurrence of cases by month showed greater variation in 1958 than in 1957, but the pattern was no different. Thus, we have some evidence that the data reported by hospitals in 1957 were reliable.

The 1958 survey of physicians was much

Table 4. Relative frequency of various categories of childhood accidents, Alameda and Contra Costa Counties, Calif., 1958

Type of accident	Number	Percent	Type of injury	Number	Percent
Automobile accident	1, 521	5. 3	Contusion or abrasion	5, 517	19. 3
Fall	8, 740	30. 5	Sprain or strain	1, 088	3. 8
Caught in device or object	1, 439	5. 0	Fracture	2, 032	7. 1
Hit by object	5, 641	19. 7	Head injury	989	3. 5
Fire or explosion	99	0. 3	Burn	758	2. 6
Ingestion	2, 633	9. 2	Poisoning	2, 307	8. 1
Other	8, 549	30. 0	Other	15, 931	55. 6
Total	28, 622	100. 0	Total	28, 622	100. 0

more satisfactory in terms of completeness of reporting. Of 724 physicians asked to participate, 474 (66 percent) cooperated in the survey. A total of 753 case reports were submitted, and of these, 131 patients were referred to a hospital, leaving 622 who would not otherwise have been reported to us. On the basis of the percentage response, we estimate that about 950 accidents occurred during the 2 weeks. During the same 2 weeks, 1,358 accidents were reported from the hospitals. Thus, a higher proportion of our estimate of the total medically attended injuries came from the hospital reporting system in 1958 (59 percent) than in 1957 (46 percent).

There seemed to be a tendency in 1958 for more seriously injured patients to seek treatment in hospital emergency rooms rather than in physicians' offices; for example, 4 percent of the cases reported by the hospitals were admitted to inpatient services as compared with 2.9 percent of the cases reported by the physicians during the same time period. The chance of a poisoning case being seen in a hospital was about 4 times greater than in a physician's office. As in 1957, a relative excess of cases was reported on Saturday and Sunday from the hospitals and a relative deficit for those days from the physicians. When the two groups are combined, there is little variation according to day of the week of the accident.

Discussion

An epidemiological study of accidental injury illustrates many of the problems common to studies of conditions for which an etiological agent is not well defined and the spectrum of illness is not clearly demarcated.

Consideration of etiology in relation to accidental injury may easily become bogged down in a semantic mire, for in the complex of events leading to an observed injury many different kinds of factors may be considered causal. For example, when a child falls from a high chair to the floor and suffers an injury, the cause may be considered to be a hard floor, an unwary child, a careless mother, or such an abstraction as height. This line of thinking seems profitless, and we therefore suggest that no attempt be made to define etiology in such restricted terms. Rather, the personal, social, and environmental factors should be considered as a whole, and patterns should be sought in the interrelationship of all of these.

What constitutes an accident can only be determined arbitrarily. An incautious child, in the care of a distracted mother, sitting in a high chair over a hard floor may be considered to be an accident about to happen. However true this may be, precise measures of the risk of such a circumstance are not easily determined. At some age nearly all children are incautious, at some time all mothers are distracted, high chairs by definition are high, and most floors are hard. If this incipient accident, then, is characteristic of the great majority of households with small children, and if injury is a random event within such households, no epidemiological study is needed, for the purposes of the study, to determine high-risk groups and to explain the reasons for the increased risk, cannot be satisfied.

One of the difficulties in many accident control programs has been the tacit acceptance of the philosophy of universal risk. Obviously, given our example, a control program may be proposed and carried out without detailed study. Mothers can be warned (repeatedly) of the general lack of healthy acrophobia in normal children; a widely publicized campaign to saw the legs off high chairs may be instituted; and more efficient shock-absorbing floor coverings may be designed and their purchase urged. To date, however, control programs of this nature have not been attended by striking success in reducing accidents.

Alternative hypotheses are (*a*) that hazards

Table 5. All childhood accidents reported by hospitals, by age, Alameda and Contra Costa Counties, Calif., 1958

Age (years)	Number	Percent
Under 1	840	2.9
1	2,899	10.1
2	3,693	12.9
3	2,876	10.1
4	2,432	8.5
5–14	15,556	54.3
Unknown	326	1.1
Total	28,622	99.9

are usually not uniformly distributed and (*b*) that in environments where certain hazards are almost always present injuries are not randomly distributed, but are related to other measurable attributes of the persons and objects involved. These hypotheses imply that accidents are not truly accidental but are determined and, to a degree, are predictable. Studies directed toward discovering the factors involved in accidents other than those physical objects immediately apparent may provide clues to new approaches to accident control or may indicate ways to increase the effectiveness of control programs of the kind mentioned previously.

Given an accident, the result may be no detectable injury through mild to severe to fatal injuries. Generally, the events that are most susceptible to study are the injuries of sufficient seriousness to require medical attention. While these may constitute only a small fraction of the total injuries of a given class, they are the most important group in terms of disability and therefore command a higher priority of attention.

Medically attended accidental injuries may be subdivided according to the place where treatment is given—at home, in a physician's office, a hospital emergency room, or a hospital ward—and by the subsequent disposition of the case. In this study, major effort was concentrated on cases seen in hospital emergency rooms, although some of these were referred to the hospital after first visiting a physician's office or following a physician's home visit. This information has been supplemented to some degree by the inclusion of a brief period of reporting of cases seen in physicians' offices. But our data omit accidental injuries not seen by a physician at all and some of those which required direct admission to the inpatient services of the hospitals. The extent of the distortion which these omissions introduced cannot be evaluated at present, although additional studies underway and being planned will help to clarify this point.

The occurrence within one year of more than 27,000 accidents actually or potentially serious enough for the patient to be seen in a hospital emergency room in a population of about 350,000 children is ample evidence of the magnitude of this problem and its impact on the medical facilities of a community. The evidence from the survey of practicing physicians' experience suggests that a like number are seen and treated in their offices. Our estimate, then, is that about 1 in every 6 or 7 children under 15 years of age receives medical attention for accidental injury in the course of a single year.

The observed variations in the risk of accidental injury related to differences in age and sex are consistent with previous reports. For example, the male-female differences probably reflect the greater venturesomeness of boys and their greater propensity for engaging in vigorous, poorly restrained physical activity. It would be expected that the sex differential in activity would increase with age, and the data fit this idea well as the relative excess among boys increases consistently throughout the age span included in this study.

With respect to the age-specific occurrence of accidents, the curves are surely related to important factors of exposure and physiological and emotional maturity. The low risk of accidental injury in the first year of life is determined by the relative insulation of the infant from the hazards of his environment, achieved by parental care and protection and by the limited mobility of the infant. The peak incidence in early childhood is a composite of a number of different kinds of accidents, many of which show a coincidence of their highest risk in this age period. This seems to be due to a rapid but still imperfect neuromuscular development of these children which provides them with the physical capacity for getting into hazardous situations before their emotional development has progressed far enough to provide them with the caution and recognition of danger which later modify the risk of accident.

Not all accidents follow this pattern, however. Automobile accidents and certain types of accidents related to sports continue to increase in frequency throughout the age span included in this study. These instances are almost entirely attributable to increasing exposure to the risk of accidents of this type, and in these cases maturation plays a significant role in increasing the risk, as the child graduates from jungle gym to football and from tricycles to automobiles.

The seasonal distribution found here is probably largely determined by the seasonal variation in exposure to risk. The summer peak is thus attributed to the larger number of daytime hours spent outside in activities which are less likely to be closely supervised by an adult. The same sort of argument may be applied to explain the distribution by day of week, with Saturday and Sunday offering the possibility of longer exposure. Also, the presence of two parents on the scene, reinforcing each other's worries, may increase the chances of an injured child being brought to treatment. Finally, the fact that many physicians do not keep weekend office hours may play a part in increasing the chances of an accident patient coming to the hospital instead of receiving office treatment. The relative importance of these various possible explanations cannot be evaluated from our data.

The findings relating to the places where the accidents occurred are not remarkable. In general, accidents occur in and around the house about as would be expected from our knowledge of probable location of hazards.

Comparison of these data with those reported in other studies clearly would be desirable. Our attempts to do this have not, however, been very successful. Comparison is hampered by:

1. Differences in classification of accidents and in definitions for similar classifications.
2. Differences in study design, especially with respect to the inclusion or exclusion of certain segments of the population, the exclusion of particular classes of accidents, and the methods used to collect information.
3. The lack of rates. Most of the reported

Table 6. Percentage distribution of different types of accidents in children aged 0–14 years, from selected studies

Type of accident	San Francisco home accident study [1]	San Francisco emergency hospital reports [1]	Santa Barbara study [1]		Alameda-Contra Costa study
			1955	1956	
Automobile accident	([2])	4.6	5.7	5.4	5.6
Fall	34.1	35.0	36.7	32.2	33.0
Caught in device or object	10.3	4.8	4.4	5.7	5.3
Hit by object	24.3	21.6	26.2	25.5	18.6
Stepped on object	2.4	5.4	4.5	3.8	5.2
Fire or explosion	2.6	0.5	0.8	0.5	0.3
Firearms	0.0	0.0	0.0	0.0	0.1
Ingestion	14.5	4.6	7.5	9.4	9.5
Strangling or suffocation	0.1	0.0	0.6	0.4	0.1
Other and not specified	11.8	23.6	13.5	17.1	22.4
All types	100.1	100.1	99.9	100.0	100.0

[1] Reference 3. [2] Excluded.

Table 7. Attack rates per 100 persons per year for accidental injuries, by age and sex, from selected studies

Age (years)	New Bedford, Mass.[1]		Washtenaw County [2]		National Health Survey [3]		Alameda and Contra Costa Counties [4]	
	Males	Females	Males	Females	Males	Females	Males	Females
Under 1	1.5	1.6	8.6	8.8	32.7	20.9	2.9	2.4
1–4	8.1	5.1					12.7	8.8
5–9	7.8	4.2	9.4	8.0	30.1	18.3	9.0	5.1
10–14	6.7	2.6	5.5	4.2			8.4	4.2
Total	7.1	3.9	8.2	7.4	----	----	9.6	5.8

[1] Reference 4. [2] Reference 5. [3] Reference 6. [4] Based on hospital reports only.

studies are based on a series of cases which cannot be related to a definable population.

In comparing the relative frequency of the different types of accidents, the problem of classification is very significant. Even making allowances for minor differences in terminology will not allow comparisons to be made between studies employing a dual method of classification, such as we used, and those using only a single list of categories. Therefore, only data from other studies made in California (*3*) may be used. This comparison is given in table 6. The results of these five sets of data are very similar, well within the limits of error when it is remembered that the studies were done in different ways, with different people classifying the individual accidents, and that there was a spread of some 5 years from the first to the most recent.

A limited comparison between studies was possible in terms of age- and sex-specific attack rates (table 7). Again the data show similar patterns. The study reported by Rice and coworkers (*4*) was based on data collected from hospitals, private physicians, schools, and other sources in New Bedford, Mass. The Washtenaw County cases (*5*) were collected by interviewing a probability sample of households, and the data presented relate to injuries of a severity comparable to those included in our data. The National Health Survey data (*6*) were obtained from interviews of a probability sample of about 36,000 households throughout the United States during the period July 1957 through June 1958. Since our estimated attack rates for Alameda and Contra Costa Counties for all medically attended accidental injuries are approximately twice the rates given in table 7, which are based on hospital reports only, there is considerable difference between the estimates derived from the various studies. The Massachusetts and Washtenaw County rates are about half as great as those from Alameda and Contra Costa Counties and the National Health Survey rates are about a third higher. The reasons for these differences are not apparent.

The Alameda-Contra Costa Counties study has fulfilled three of its stated purposes well. First, the magnitude of the problem of childhood accidents is clearly demonstrated, for the incidence is high even after the minor injuries are discounted. Second, the results of this study have already been used in planning two additional studies, one on poisonings and one on burns. Third, the data collected for 1957 are confirmed by the 1958 findings, and a continuation of this reporting procedure is planned so that variations in incidence over a longer period of time may be reckoned and a well-defined baseline may be developed.

The fourth goal, to gather information on which preventive programs may be based, was not so well fulfilled, however. Certainly, these data have given us a clearer picture of the relative significance of various types of accidental injuries and have raised many provocative questions needing further study, but the findings are too crude to identify the specific factors in the etiology of accidents which are most vulnerable to attack.

Summary

By means of brief report cards completed by the staffs of the emergency rooms of the hospitals in Alameda and Contra Costa Counties, Calif., the incidence of accidental injuries to children under 15 years of age is calculated as 78.2 per 1,000 children per year. Reports from practicing physicians indicate that an approximately equal number are receiving office treatment, for a total incidence of medically attended accidents in these counties of about 150 per 1,000 children per year.

More than half the cases reported from the hospitals were minor and only 4 percent required inpatient care, although the severity varied widely for different types of accidents and different categories of injury. The age at greatest risk of accidental injury was between 2 and 3 years; certain categories, however, showed an increasing risk with increasing age throughout the age span under study.

The data collected are not detailed enough to allow intensive analysis, but the findings will be useful in planning future studies of specific kinds of accidents.

REFERENCES

(*1*) Berfenstam, R.: A critical review on different types of accident morbidity studies. Courrier 7: 349–360, July–August 1957.

(2) Cobb, O., Williams, J. H., and Corsa, L., Jr.: Childhood accident prevention: Program and statistical survey by a county medical society. California Med. 91: 62–64, August, 1959.
(3) Home safety project: Final report, 1953–1957. Monograph. Berkeley, Calif., State Department of Public Health, 1957.
(4) Rice, R. G., Starbuck, G. W., and Reed, R. B.: Accidental injuries to children. New England J. Med. 255: 1212–1219, December 27, 1956.
(5) An investigation of the causes of home accidents. Progress report. Ann Arbor, University of Michigan School of Public Health, Department of Public Health Statistics, March 1952.
(6) U.S. National Health Survey: Persons injured by class of accident, United States, July 1957–June 1958. PHS Pub. 584–B8. Washington, D.C., U.S. Government Printing Office, 1959, p. 29.

PUBLICATION ANNOUNCEMENTS

Blondie Mental Health Calendar (1961–62) and *Blondie Mental Health Bookmark.* Office of Mental Health Education and Information, New York State Department of Mental Hygiene, 240 State Street, Albany.

Housing Codes. The Key to Housing Conservation. Vol. 1. Background of Code Enforcement. Vol. 2. Model Housing Code Applicable to One- and Two-Family Dwellings, Multiple Dwellings, Mobile Homes, and Mobile Home Courts. Vol. 3. Administrative Guide. A demonstration project by the New York State Division of Housing in cooperation with the Housing and Home Finance Agency. 1960; 42 pages. New York State Division of Housing, New York.

Group Health & Welfare News. Vol. 1, No. 1, September 1960; 8 pages; $4 per year. Group Health Association of America, Inc., 343 S. Dearborn Street, Chicago 4.

Protein and Amino Acid Requirements in Early Life. By L. Emmett Holt, Jr., Paul György, Edward L. Pratt, Selma E. Snyderman, and William M. Wallace. 1960; 63 pages; $1. New York University Press, Washington Square, New York 3.

Schistosome Dermatitis (Swimmer's Itch), Its Cause, Prevention, and Control. Leaflet. Minnesota Department of Health, University Campus, Minneapolis 14, Minn.

Report of the Subcommittee on Organization for Health. Committee on Medical Care, Maryland State Planning Commission. Publication 109. June 1960; 22 pages; 50 cents. State Planning Department, 1103 State Office Building, Baltimore 1, Md.

If Your Child Has a Congenital Heart Defect. 1960; 47 pages. American Heart Association, 44 East 44th Street, New York 10.

Increasing the Effectiveness of Western Science. 1960; 18 pages. National Science Foundation, 1951 Constitution Avenue NW., Washington 25, D.C.

Looking Ahead to Retirement. Manual for discussion leaders. 1960; 43 pages. *Looking Ahead to Retirement.* A retirement education program. Discussion guide. September 1960; 369 pages. *Older and Retired Workers Plans, Programs, and Services in the Field of the Aging.* 1960; 31 pages. Committee on Retired Workers, United Steelworkers of America, 1001 Connecticut Avenue NW., Washington 6, D.C.

The Challenge to Labor Following the White House Conference on Aging. Paper delivered by B. W. Ohler at Conference on Aging, Ann Arbor, Mich., June 27, 1960. 8 pages. Committee on Retired Workers, United Steelworkers of America, 1001 Connecticut Avenue NW., Washington 6, D.C.

Sunlight and the Skin. 11 pages. Committee on Cosmetics, American Medical Association, 535 North Dearborn Street, Chicago 10.

Funds for Research and Development in Industry, 1957. Performance and financing. Surveys of Science Resources Series. NSF-60-40. 1960; 119 pages; 65 cents. Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C.

SEC Technical Reports

A limited number of the following reports are available from the Sanitary Engineering Center, Public Health Service, Cincinnati, Ohio. Order by number.

Radiation Surveillance of the Environment. Technical Report R59–5. By Conrad P. Straub. 1959; 16 pages.

Radionuclide Analysis of Environmental Samples. A laboratory manual of methodology. Technical Report R59–6. Edited by Paul F. Hallbach. November 16, 1959.

The Bacteriological and Chemical Behavior of Silver in Low Concentrations. W60–4. By Cecil W. Chambers and Charles M. Proctor. 1960; 18 pages.

Air Pollution in Hamilton, Ohio. A60–8. By Paul A. Kenline. 1960; 12 pages.

Publications. Section 2. Milk and food. F60–1. 1960; 11 pages.

Address inquiries to the publisher or sponsoring agency

Safety for Florida Children

MARVIN L. WEIL, M.D.

A JOINT effort in the prevention of accidents to children in Florida has succeeded remarkably through the close relationship which has developed, during the last 5 years, between the organized pediatricians and public health and other interested agencies.

The pediatricians' groups engaged in this activity are the Florida Pediatric Society and the Florida Chapter of the American Academy of Pediatrics. Though these are separate organizations, almost all members of the Florida chapter of the national society also belong to the Florida Pediatric Society, which has the larger membership within the State. The two societies have for some time appointed the same persons to their standing committees; thus, work for accident prevention has been initiated and guided by one committee serving both groups.

Poison Control Centers

Active participation by Florida pediatricians in accident prevention began in 1952, when they selected poison control for their initial focus. Under the chairmanship of Dr. Robert Grayson, the joint Accident Prevention Committee decided to establish some 15 poison control centers in strategic spots throughout the State.

The job required pioneering, for at that time there were no existing guides for setting up poison control centers, nor even many ideas as to what their function should be. In fact, it was against the advice of national experts that Dr. Grayson's committee began the compilation of the first Florida poison control file cards for use in the centers.

Some 1,000 cards were compiled, primarily by volunteers, for indexing in two groups. One file was of toxic substances and indicated appropriate therapy, while the second indexed many commerical products and gave their toxic ingredients.

All these cards were then duplicated, and doctors and their families worked at night separating, indexing, and distributing complete sets to the poison control centers. In addition, hospitals were asked to contribute equipment, and the Florida Pediatric Society purchased a basic library for each center.

An exhibit which was prepared to inform doctors throughout the State about the program was later shown at the national meetings of the American Academy of Pediatrics, the American Medical Association, and the American Public Health Association. This exhibit aroused such widespread interest that many requests were received for copies of the file cards. Fifty sets were reproduced and promptly sold.

Soon it became apparent that the poison control centers served a very real need, but their maintenance was a burden to professional societies with limited funds and physician members with limited time. New cards for previously unlisted substances were constantly needed for the files, and the new cards had to be duplicated and distributed to the centers. Reports of poisonings had to be collected and summarized as well as searched for ideas on the treatment and prevention of poisoning. In Florida, as in other States, it was recognized

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that a clearinghouse for information on poison control was needed.

In 1957, the Public Health Service responded to this need by establishing the National Clearinghouse for Poison Control Centers. One of the first services performed by the national clearinghouse was the printing and distribution of poison control file cards, for which the Florida file served as the prototype. Other services to poison control centers include the provision of statistical evaluation of data on poisonings, inspection teams, new file cards for newly recognized poisonous substances and therapy, a monthly bulletin, distribution of poison reporting forms to be used for reporting back to the national clearinghouse, and liaison with industry.

In Florida, the State board of health has for some time assisted in the program. It has taken over all statistical work in connection with poisonings in Florida; it has helped transport our heavy exhibit around the State; and we have been especially grateful for its offer to reproduce any cards we compile on special problems in Florida. Thus, we are able to supplement the cards from the national clearinghouse with information of purely local concern such as that presented in a publication entitled "Poisonous Plants Around the Home," which was prepared by the agricultural experiment stations of the University of Florida.

At present, the Accident Prevention Committee of the Florida pediatricians' societies has a subcommittee on poisons which operates the poison control centers throughout the State. The State board of health serves in an advisory capacity to us, and we to it. The 19 centers seem to be joint property.

General Program Outlines

Once the poison control centers were well established, accident prevention in its entirety was reexamined by the pediatricians' societies. By 1957, we had accepted a general basis for action by the joint Accident Prevention Committee:

1. Rather than conducting direct public campaigns, the committee should give overall stimulation and guidance to the accident program and physicians' efforts on its behalf.

2. The committee's primary function should be the education of physicians, who are in an excellent position to arouse local concern about accident prevention and who can be expected to make use of any good accident prevention materials brought to their attention. Physicians should be made aware that accidents are the chief health hazard for children and should be encouraged to regard accidents as a disease which must be fought.

For a beginning, we requested informational materials from the National Safety Council and affiliated as members of the council.

Our original plan was for the chairman of the State committee to disseminate material to his subcommittee chairmen, who would in turn distribute material to local committees. We wanted our men to engage in active work at the local level. They were to promote safety campaigns and to consult and work cooperatively with other agencies on local accident prevention problems. The plan did not work well at first. The committee chairman sent out encouraging letters, but response was meager.

To start the ball rolling, we purchased two safety kits from the National Safety Council and sent them to each member of the Accident Prevention Committee. The provocative articles, ideas for programs, and data contained in the "Home Safety Program Kit" and the "Child Safety Program Kit" stimulated committee members. The following specific areas were chosen for emphasis:

1. Education of parents about accident prevention problems in general.

2. Measurement of radiation output and scatter of medical X-ray equipment used in pediatrics.

3. Prevention of traffic accidents.

4. Development of a poster on "What to Do in Emergencies" of a size suitable for mounting inside household medicine cabinets.

5. Orientation of baby sitters, with instructions for both parents and sitters.

Safety Pamphlet Distribution

The American Academy of Pediatrics had reprinted for sale a series of leaflets originated by the San Jose (Calif.) City Health Department, giving safety precautions for each stage in a child's growth. Every pediatrician and

FASTEN INFANTS AND SMALL CHILDREN IN A BABY BASKET OR SAFETY SEAT

- It's safer to drive with small children in the back seat but be sure back doors cannot be opened by children.
- Children of every age are less likely to be injured severely if protected by a seat belt.
- If you do allow your child to ride beside you — watch out! He can bash his head against the dash.
- Parents can do a better job of driving if there is order in the car. Insist on it!
- Forbid children to put their heads or arms out of the car windows while it is in motion.

Excerpt from "The Young Passenger," a folder designed for distribution by pediatricians and the department of public safety in Florida's safety campaign

general practitioner, we felt, should have a supply of these pamphlets to hand to his patients.

The State board of health agreed to adopt the leaflets for statewide use. Every member of the Florida Medical Association received one set of leaflets with a note pointing out that additional copies were available, without charge, from the State board of health. Free copies were also available to health clinics throughout the State. Three printings of 10,000 sets were quickly exhausted.

Having arranged for a supply of the San Jose leaflets, we undertook to create a demand for them from physicians by such means as county drives, encouragement at meetings, and personal persuasion. We feel strongly that any project we bring to the notice of the State board of health must be supported to the hilt. Therefore, we devote much of our effort to fostering demand among physicians for accident prevention materials, and especially for those that have been made available by the State board of health at our suggestion.

The distribution service provided by the Florida State Board of Health has been most helpful also. Many times they have included our material with their regular mailings, and on occasion they have cooperated by sending out special mailings. For example, "Sink or Swim," a pamphlet called to our attention by the National Safety Council just as the 1959 summer swimming season approached, was purchased by the Florida Pediatric Society and mailed by the State board of health to members of both pediatricians' societies.

Medical X-ray Survey

There has been a strong feeling among members of the Accident Prevention Committee that pediatricians and other physicians should be aware of the exact radiation output and scatter from the X-ray machines they use in medical practice. We felt that despite the educational efforts of many groups calling attention to the hazards of radiation and delineating safe values and practices, few physicians had cer-

tain knowledge of the output characteristics of their own machines. If some way could be found to determine the output of all such machines, physicians could take appropriate corrective measures for any not conforming to present standards. Definite information would provide physicians with an opportunity to conduct their own program for improving this aspect of professional practice.

The State board of health was establishing its radiological health section even as we were encouraging local medical societies to request surveys of X-ray machines and as the interest of the Federal Government in the subject was mounting. A survey, recently completed on all X-ray and dental machines in Dade County, is expected ultimately to reach every machine in the State.

Automobile Accidents

Dr. Oliver Deen, a subchairman of the joint Accident Prevention Committee for the Tampa area, chose to work on traffic accidents involving children. After consulting with the Florida Highway Patrol, Claudius Walker of the State's accident prevention program, and local groups, he realized that here, as in many accident problems, information as to how, where, and why traffic accidents occur was essential. Only armed with this kind of information could he plan an intelligent attack upon traffic accidents. In collaboration with the National Safety Council and the State board of health, he developed a survey questionnaire which was reproduced by the State board of health and is now in hospital accident rooms and pediatricians' offices of Hillsboro County. This survey is also being extended to other counties.

Not content to bypass the traffic problem pending results of the survey on traffic accidents involving children, information already yielded by the survey has been used in preparing a series of lectures and slides on children and traffic safety. In addition, "The Young Passenger," a folder currently enjoying wide and successful distribution throughout the State, is the product of our working in conjunction with the State highway patrol and the State board of health to evolve something concise, attractive, and pertinent for the physician to use.

Accidents With Toys

Accidents to children at play, and particularly accidents caused by toys, are the subject of a statewide study currently underway. Both the pediatricians' groups, the State board of health, the National Safety Council, and a local medical society that operates in five Florida counties have joined forces to survey accidents of this type occurring in three study months: June and October 1960, and February 1961. Data for these study periods is being provided by all the pediatricians in the State, selected hospital emergency rooms, and the five-county medical society. The data will include place of accident (house, yard, driveway, street, playground, or other), the plaything or toy involved, the victim's sex, the nature of the injury, and the part of the body affected.

Completion of the study on accidents with toys will provide factual information of great help to us in fulfilling an allied aim. We should like to conduct an educational campaign on the selection of toys that are safe and that have genuine play and development value. Such a campaign also would help to focus parental attention on the emotional growth and development of children.

Baby Sitter Orientation

The baby sitting service has developed from an innovation, a few years back, to a regular part of today's culture. Its growth has been so fast and so haphazard that almost no standards for the performance and the use of this service have been widely promulgated or adopted. Many parents, for instance, fail to leave proper instructions for their sitters.

At our suggestion, a modified version of the National Safety Council's form giving permanent and temporary instructions to baby sitters was printed as a pad by the State board of health. A campaign to stimulate use of these pads by parents in Dade County is being conducted jointly by the county medical association and the health department, the State board of health, and our pediatricians' group. Every physician in Dade County, one of Florida's metropolitan counties, has received at least one of these pads by mail, and pediatricians and general practitioners have received 10. At the

same time as the physicians were urged to promote use of the pad by their patients, the public was encouraged by press, radio, and television to ask physicians for the pads. The physicians, in turn, not only have encouraged adoption of the form by the general public but also have persuaded nonmedical groups to reproduce and distribute the form. This project in popular education by physicians has attracted considerable interest here and in other parts of the country.

We hope to extend the project to other areas of the State and also to see classes for baby sitters established as a secondary result of the campaign. If that happens, we shall have made a significant beginning on parent education, for the teenagers trained to be better baby sitters today will become better parents tomorrow.

Ideas in Process

A number of other projects are under consideration or are in the process of development.

For example, Dr. Thomas Brill, subchairman for accident prevention in the Gainesville area, has been working on a one-page placard telling "What to Do in an Emergency" and eliminating the usual "don'ts." We hope to convince the State board of health that this item will be worth reproducing and distributing for mounting inside home medicine cabinets.

Another project contemplated is a traveling exhibit to acquaint doctors with a collection of the really good accident prevention material already in existence, along with a list of sources. We believe that when physicians learn what is already available they will use much more of this material in their offices.

We should like to see a newsletter established to bring safety news to professional people all over the State. For instance, a Dade County promotion campaign for the "San Jose leaflets" was quite effective. A newsletter of this type could let others know what was done in Dade County. It would also be an excellent means of popularizing new accident prevention and treatment techniques.

One project, we feel, would be more difficult but more important than any of the others. More and more, as the years pass, we need a comprehensive accident survey, similar to some of the county surveys done in Georgia, in both a rural and a metropolitan area of this State.

At present we direct our program at various facets of the accident problem according to whim, when we should be attacking according to plan. It is time to find out just who are our most formidable antagonists. What are the really important accidents in Florida? Should we concentrate first on water safety or on power mowers? We need to know what types of accidents are occurring, how severe they are, and how often they occur. For valid answers to these questions, a proper statistical study of all accidents, from minor finger cuts to those requiring a physician's attendance, should be made. Our group is anxious to cooperate, but for this we need help and guidance.

Lessons From Experience

In Florida, it is the close cooperation among several interested agencies, each contributing in a different way, which makes work for accident prevention productive and rewarding. Our group of pediatricians is able to make professional comment on programs and informational materials and usually has ideas and enthusiasm to offer. In addition to giving us guidance and support, the State board of health, through its accident prevention program, frequently provides and distributes materials we help to select or develop. The National Safety Council offers good informational materials, as well as the very helpful encouragement and advice of Phyl Dykstra, home safety chairman for the council. We have had the considerable benefit of generous aid from professional advertising groups in the design and layout of new pamphlets and leaflets. A recent example of the growing support to our program from other nonmedical organizations was the reproduction and distribution by a Miami Beach savings and loan association of a wallet-sized card giving instructions for applying mouth-to-mouth resuscitation.

Recognizing that amateurish literature is an abuse of the physician's time and confidence, we have learned to know and make use of good existing materials and to employ professional aid in the preparation of new literature and other materials. With a physician to deter-

mine the substance and a technician to prepare the form, we have found it possible to develop messages which are both sound and effective.

We try a new project in one locality. If it proves worthwhile, we make the program modifications necessary to capitalize upon initial successes and rectify initial mistakes, and then we extend the project to other areas in the State. Frequently we use the projects to stimulate our own subchairmen throughout the State, for we have discovered that those of our members who have been given the most to do have developed the greatest interest in accident prevention.

Monkey-Mosquito-Man Malaria Experiment

Transmission of monkey malaria to man through the bite of an infected mosquito—an experimental feat which may compel scientists to reexamine long-established knowledge on the transmission cycle of this disease—has been reported by scientists at the National Institute of Allergy and Infectious Diseases, Public Health Service.

This finding challenges the concept of malaria investigators throughout the world that types of malaria infecting animals cannot be transmitted to man by the bite of an infected mosquito. Up until now, only by artificial method, blood inoculation, has it been possible to infect man with monkey malaria.

Results of the study are summarized in the June 17, 1960, issue of *Science*, official publication of the American Association for the Advancement of Science. The authors are Dr. Don E. Eyles, Dr. G. Robert Coatney, and Dr. Morton E. Getz, all of the institute's Laboratory of Parasite Chemotherapy.

The authors emphasize that the possibility of a monkey-mosquito-man cycle of malaria infection in nature is still conjectural. They also point out that the practical effect of this new knowledge on malaria eradication in areas having nonhuman primates is unknown.

The authors believe that research on lower monkey malarias, with particular regard to the possible existence of reservoirs of human infection or sources of reinfection of man with new strains is a necessary adjunct to the malaria eradication program. They expect to study monkey-human malarias in detail and reexamine the entire question of the host-specificity of primate malarias.

The study originated from accidental infections involving Dr. Eyles and an assistant at the institute's Memphis laboratory, in the course of a routine study in which large-scale inoculations of monkeys with primate malaria were being carried out. Malaria parasites were demonstrated in the blood of both workers. Neither had had recent contact with human malaria. Blood from one of the infected workers was injected into two inmate volunteers at the Federal penitentiary in Atlanta, Ga. Both developed clinical attacks of malaria but neither exhibited high parasite densities. These infections are still under study.

In two subsequent planned infections of staff members who volunteered, the first allowed 30 to 50 *Anopheles freeborni* mosquitoes heavily infected with monkey malaria to feed on him. Eleven and twelve days later he experienced typical symptoms of malaria infection: headache, malaise, and elevated temperature. When parasites could not be demonstrated, a sample of his blood was injected into an uninfected monkey, which 6 days later came down with malaria, indicating a low-grade infection of the human subject.

The second member allowed himself to be bitten by 10 mosquitoes heavily infected with the strain of primate malaria and 14 days later came down with clinical malaria. Parasites were easily demonstrated in his blood. After standard antimalarial treatment, both volunteers had an uneventful recovery.

According to the authors, the findings of this investigation underline the need for immediate and intensive studies of monkey malaria in various parts of the world.

Problems of the Statistician in Collaborative Research

HYMAN GOLDSTEIN, Ph.D.

COLLABORATIVE research in its finest sense can be an adventure in thinking, working, and giving together in science. The statistician has the rare opportunity of trying to make it work.

But the collaborative study of cerebral palsy and other neurological and sensory disorders of infancy and childhood, supported and coordinated by the National Institute of Neurological Diseases and Blindness of the Public Health Service, supplies an example of the difficulties of collaborative research and the resulting problems for the statistician.

This is a prospective study to determine the relationship of certain biological, genetic, and environmental factors in parents to the occurrence of abnormalities in the products of conception.

An adequate study of reproductive failure must fulfill four basic requirements if it is to succeed:

1. The study must be capable of evaluating simultaneously the many etiological factors which may be responsible for causing fetal wastage.

2. The varied abnormalities or forms of fetal wastage must be observed and differentiated.

3. The data obtained must not be subject to bias which would set up spurious correlations between prenatal events and postnatal defects.

4. An adequate number of cases must be studied to make possible the establishment of statistically significant correlations.

Since a number of separate institutions across the country are collaborating, it is essential that the study be conducted according to a single design, the data being collected and recorded in a uniform fashion and reported to a central office for continuing analysis.

In this investigation, the gravida (pregnant woman) is the starting point. Since it is not possible to determine in advance which outcomes will be normal and which defective, the study has built-in controls. There is interest in all products of conception and, in effect, disorders of all body systems, not merely the neurological, whether such abnormalities appear at time of delivery, during infancy, or during early childhood.

The study is still in the phase of pretesting study forms and data collection procedures. Of the 15 institutions in the study, 13 serve, and hence contribute to the study, obstetrical clinic populations heavily weighted with Negro gravidas of low socioeconomic status. The other two institutions collaborate by followup of babies born in project hospitals in their communities.

It is necessary to obtain from prospective parents detailed information on genetic, biological, and environmental factors which might be germane, both before and during pregnancy. The pregnant woman is subjected to detailed and meticulous examinations throughout pregnancy and during labor and delivery. An equally detailed evaluation of the products of conception, including both those resulting from

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uncompleted pregnancy and those at term, must follow. Periodic evaluation of the live offspring is to be continued throughout infancy and early childhood, including general and special examinations at regular intervals and pathological examinations whenever possible.

The factors and conditions to be investigated in the parents are:

1. Conditions of pregnancy itself, such as infection, trauma, bleeding, drugs, and progress of labor. This includes the normal and abnormal physiology of pregnancy, labor, and delivery.

2. Environmental factors influencing the mother, such as socioeconomic conditions, emotional stress, and medical care.

3. Biological factors, such as age, parity, medical and reproductive history, and immunological characteristics.

4. Genetic background.

It should be emphasized that the necessity for accurate detailed data is not confined to information regarding the causative factors during pregnancy, but applies also to the evaluation and categorization of presumed result or defect. The study will require accurate and detailed differentiation of the types of abnormalities observed.

What are some of the methodological issues that the statistician in collaborative research must face? Many are no different from those found in noncollaborative research, but the sources of variation in collaborative research are more numerous in all areas. Some of the issues may be described under size of sample, case selection, followup, the data and their reliability, and results.

Size of Sample

Using the expected incidence of 5 cases per 1,000 live births for cerebral palsy within the first year of life and assuming that approximately 40,000 live births will be studied, some 200 cerebral palsy cases are expected. This is considered the minimum number of cerebral palsy cases required for analysis, in view of the great number of variables to be cross-classified and the fact that cerebral palsy is a complex disorder manifesting itself in different ways. One thing is certain, because of the low incidence of many of the conditions and the multiplicity and interrelationship of the various factors of pregnancy under study, a large number of cases is essential. The goal of 40,000 live births is believed possible from a total of 50,000 pregnancies, making allowance for expected fetal loss. Even with a sample of this size, it is problematical whether the study will provide a sufficient number of damaged cases to permit the achievement of statistically significant conclusions.

If it is assumed that 40,000 live births will be studied, one may well ask: What sort of differences in incidence rates might be observed with this number? Lilienfeld and Parkhurst (*1*) observed in an extensive series of some 95,000 live birth certificates an incidence rate for cerebral palsy of 5.3 per 1,000 among children whose mothers had no complications associated with pregnancy and parturition. Among children whose mothers had such complications (slightly more than 1 percent), the incidence rate for cerebral palsy was 18.2 per 1,000 live births. If such a difference should exist in the population to be studied by the collaborative project, would it be possible to detect it by the usual statistical means? Or, thinking of it slightly differently, what would be our probability of detecting it with the study patients?

Assuming that the figures just given are true for the collaborative project, the difference would have about a 25 percent chance of being missed, at the 1 percent significance level. At the 5 percent level, the chance of being missed is 13 percent.

Tests of this sort were made for a number of other incidence rates in the literature. It should be pointed out that the incidence rates for conditions and defects are based on a spotty literature. Quite often the rates apply to a specific hospital or to a given locality, or the method of selection is biased or obscure. Furthermore, whatever is available represents only a few conditions or defects. There is no way of determining the chances of detecting significant differences for conditions or defects for which no incidence rates are reported.

It seemed fairly certain that for a number of particularly uncommon causes or conditions, the contemplated size of sample would be inadequate, especially with so many variables to

be included in this study. It seemed, therefore, that some method had to be found for permitting inclusion for analysis of a larger number of damaged or defective children. Such data could be obtained by using information already available from patients outside the sampling frame but in the collaborating institutions or from other institutions and agencies in communities where the collaborating institutions are located. Although of necessity such information might be less detailed and less definitive, it would be obtained from a larger number of pregnancies with a relatively small expenditure of effort.

Briefly, one such approach, retrospective in nature, consists of: (*a*) attempts to identify in the community, as nearly as possible, all damaged and defective children born in that community during the period of study; and (*b*) comparison of the events in the mothers' pregnancies obtained from the data available in the written records, mainly from hospitals, with data obtainable on pregnancies which resulted in presumably "normal" children.

The success of this type of undertaking depends largely on the ability to select the key items of information required, and to find ways of obtaining data on such cases which are identical to or at least comparable with the same items of information derived from the central core study. By this approach, it will be possible to study in detail certain specific suspected factors inadequately covered in the central core or "intensive phase," and to obtain valid data on incidence and prevalence of certain gross defects such as prematurity, cerebral palsy, blindness, deafness, and mental deficiency.

The various methods and studies by which the additional cases and types of data can be obtained are included under the term "extensive phase" of the collaborative project. Activities which are basic to fulfilling the objectives of the extensive phase are casefinding, record review, and the estimation of reliable and valid population parameters.

Case Selection

Because of the highly selected nature of the institutions in the intensive phase, their patients, as has been mentioned, are not a representative sample of the general population, and the experience reported, including incidence and prevalence figures for complications of pregnancy, outcome, and the like, cannot be considered representative. From this viewpoint the total sample in the project might be considered as a sample in search of a population. It was believed that the results obtained from a sample of a given hospital's obstetrical population should be generalized to the total obstetrical sampling frame of that hospital. Accordingly, in institutions not contributing 100 percent of their obstetrical population to the study, a form of systematic sampling was started, taking into account the size of the obstetrical population and the anticipated contribution. Although a basic scheme of unbiased sampling is used, it is not always possible to employ a single sampling design. There may also be slight variation from place to place regarding the basis for exclusion from the sampling frame.

For each obstetrical patient in the sampling frame, including those not registered in the study, a registration form, giving data on age, weeks of gestation, marital status, and race, is completed and sent to the central office by the institution. By periodic analysis of registration forms sent in for all obstetrical patients in the sampling frame, significant changes in number and type of obstetrical patients can be noted, and changes in the sampling ratio can be effected wherever necessary.

A number of modifications of the completely random or unbiased case selection method have been recommended by some of the collaborating institutions. The reasons for these recommendations have been several.

First, it has been suggested that the selection of patients should be based on the likelihood of a potentially higher yield of defective outcomes because of specific characteristics. Such a selection of high-risk cases might be based on parity, age, existence of previous complications of pregnancy, previous outcomes resulting in a number of abortions, and so forth. The evidence available shows that each of these factors might be associated with an increased incidence of defect in the offspring, and thus an increased likelihood of finding out more about the mechan-

ism through which these recognized factors produce defect.

However, there are a number of objections to a selection of this type. To the extent that cases are selected on the basis of known or suspected etiological factors, the likelihood of detecting presently unrecognized or unsuspected factors in perinatal morbidity is reduced when the number of patients to be studied is fixed. Furthermore, when a special selection basis of this type is set up, one can never be sure that some additional bias is not being introduced which is not evident superficially in the basis of selection used. Thus, one of the chief limitations of this technique lies in the possibility of overlooking important interrelated variables which may actually be determining factors.

A second recommended basis for case selection deals with improved ease and consistency of data collection. A number of collaborators have cautioned, for example, that if we take into the study those patients who do not report for obstetrical care until late in pregnancy, there will not be accurate data available regarding the greater part of their pregnancies. Other collaborators have used this type of reasoning to justify their desire to exclude patients from the study on the basis of unwillingness to participate or geographic factors which might make it difficult to maintain adequate followup.

The primary concern in selection procedures should be to make it possible to obtain desirable and feasible data. One must guard against the serious risk that inapparent factors may exert influence on such selection and that important influences relating to the cause of perinatal morbidity may be obscured or overlooked. Insofar as possible, a study of this type should attempt to sample as complete a population of pregnant women as possible in order to insure the broadest possible basis of experience.

As a result of analysis of data on age, marital status, and race, obtained on registration forms from all obstetrical patients coming into the hospital, it will be possible to recommend special sampling procedures, such as for patients reporting for care early in pregnancy, or for patients under 20 years of age or over 40 years of age. Furthermore, it will be possible to alter the kind of information requested on the registration forms to obtain population characteristics pertaining to new or special variables. Information of this type obtained from sampling the entire frame of patients will permit reaching decisions as quickly as possible regarding special sampling ratios.

Patients coming back to the study in subsequent pregnancies provide data of unusual interest. They give some clue as to the importance of genetic or constitutional factors in pregnancy outcome. They supply unusually valuable data in respect to exposure to virus disease, since serologic data are available over a period of time. In addition, they provide information on the reliability and consistency of some of the history items.

On the other hand, repeat pregnancies reduce the number of different pregnant women included in the study and thus reduce the potential detection of significant differences. There are several methods of dealing statistically with repeat pregnancies. Any woman previously registered may be excluded from the study. Or the study may include only those repeaters who, by chance, fall again into the sample. The number of repeat pregnancies brought into the study in this way would depend on the total number of pregnancies that come into a particular hospital and the sampling ratio.

Another method is to include in the study any woman who has previously been registered in the study; in other words, deliberately induct into the study all gravidas because of their prior inclusion in the study. The number of repeat pregnancies thus brought into the study would depend primarily on the reproductive patterns encountered in that particular obstetrical population.

The decision as to an optimum percentage of repeat pregnancies for inclusion in the study must involve a balancing of the merits of including these repeat pregnancies against the loss of independent observations. Except for certain genetic considerations and other questions where the repeat pregnancies alone are of interest, one must consider that the entire sample is reduced by the number of repeaters allowed. The fewer repeaters allowed into the study, the more factors it will be possible to detect as contributing to abnormal conditions in their children.

The effect of reducing the 50,000 independent cases by allowing repeaters among them can be measured only by noting the impact of such inclusions on the chances of missing a true difference in incidence rates for defects occurring in a population of gravidas with and without specified pregnancy conditions. The chances of missing true differences in incidence rates for specific defects associated with some eight pregnancy conditions, cited in the literature, by allowing a repeat rate not to exceed 25 percent, were determined. It was found, for instance, that, for nonpuerperal complications where no repeats were allowed, using a 5 percent level of significance, the chance of missing a significant difference was 13 percent; with 25 percent repeats, it was 17 percent. For toxemias of pregnancy, the chance was 40 percent with no repeats and 50 percent with 25 percent repeats. Even with no repeaters, there is a good chance of missing some differences for certain conditions and defects.

Unfortunately, there is very little information on which to base estimates of the number of repeat pregnancies likely to be found in the study over a 5-year period of enlisting gravidas. Analysis of previous experience of three hospitals in the study would indicate that approximately 20 percent of women delivering in these hospitals return for one or more deliveries within 5 years.

Followup

Some of the collaborators have pointed out that the contemplated long followup of numerous infants in the study is the most irksome feature of the whole undertaking. They believe that cases with a greater likelihood of some defect or abnormality being present or developing should be selected for followup. It is assumed that a carefully selected control case would be included in the study for comparison with the case selected on the basis of some presumed abnormality.

The criticisms leveled against selection of high-risk cases could also be leveled against selection of the presumed defective child for followup. Although this type of case selection would be useful in detecting the mechanism of factors or influences already suspected, it would definitely reduce the likelihood of detecting presently unrecognized causes of perinatal morbidity. Moreover, bias may easily be introduced in such a technique. The danger always exists that if a subsequent examiner learns that a case has been introduced into the study because of some presumed defect, this may have an effect on his objectivity.

A more serious disadvantage is the limited number of factors which can be used as a basis for selection of cases and controls. When different categories of cases plus controls are drawn into the study at various stages, the net result might very well be a great variety of procedures and relatively small groups of cases studied in different ways, with doubtful suitability for comparison with the main group of cases. Moreover, when all the special interest cases plus an equal number of controls are added, there is a good possibility of ending up with practically all the cases in the study. It would appear that the difficulties introduced into the study by a selection of infants based on their presumed defect outweigh any possible advantages.

Followup, one of the most critical problems of the collaborative project, was recently the subject of a careful review by one of the collaborating institutions. In a series of eighth-month examinations scheduled for a 2-week period, 86 percent were completed, 8 percent were temporarily delayed, and 6 percent were permanent losses, because patients dropped out of the study, moved out of town, or were lost for some other reason. From the foregoing it is obvious that, despite diligent effort, dropouts and delinquents are likely to pose a serious problem. Building rapport with the family, inculcating a feeling of contribution to a humanitarian effort, publicizing the project, stimulating identification with the project through various means, paying carfare for those unable to come for followup examinations otherwise, providing baby sitters where necessary, and the like are all mechanisms which can be used to try to keep the sample intact. In fact all mechanisms that have proved to be effective in tracing families should be employed, such as use of the social service exchange and skip-tracing services. It is essential not to lose the time, effort, and money invested in each neonate.

When a family is lost to followup, death certificates should be checked. This might supply endpoints for a fraction of such lost cases.

There might be differences of opinion with respect to the frequency of followup examinations, ranging from examinations to be made as frequently as possible to no followup examination until such time as the child is of sufficient age to permit a definite decision on the status of his nervous system through examination. The first approach is impractical because of the huge drain on the resources and personnel of the hospital and on the time and energy of both mother and child. The defects in the last approach are dual. The first possibility is that the nature and character of certain minor defects, evident at an early age, might be obscured by variations in training "compensation." For instance, the true nature of a speech defect can be confused when the child is not seen until after reactions to training and school experience are set. The other weakness of this approach lies in the fact that it makes no provision for evaluation of the importance of injuries and illnesses and other events which may lead to neurological damage subsequent to the birth of the child and prior to the "definitive" examination at the end of the study. The earlier a given defect can be demonstrated, the less likely its erroneous correlation with some subsequent event.

The Data and Their Reliability

In a prospective study the data recorded at any given time should not be biased by reference to preceding events or modified in the light of subsequent developments. To this end, data should be recorded at the earliest possible time after the event reported.

For the purposes of this collaborative study, it was stressed that copies of the record of an event must be forwarded to the central office for coding, processing, and analysis without delay. Examinations should be conducted, and the results recorded, without reference to previous events or examinations. Perhaps, however, the best that may be achieved is a series of mutually exclusive "bias-free" blocks, one for the prenatal data, another for the events of labor and delivery, and still another for the postnatal data, with different examiners for each of the three blocks. It is especially important that examinations of the infant are carried out without knowledge of possible favorable or unfavorable circumstances in the parents or in the environment. Sometimes the delivery room examiner of the neonate may be aware of events during delivery. If so, such awareness should be recorded so that it may be taken into account in analysis of the data.

It is recognized that the ideal is unobtainable. In many instances, the examination itself will elicit information relative to previous events. In other instances, the examiner himself may recall pertinent details from a previous contact with the patient. In addition, the necessities of time and personnel may require screening or selective procedures which of themselves are an indication to subsequent examiners of the possible existence of an abnormality. Finally, medical care and ethical considerations often require that every possible means of evaluation be utilized.

The achievement of uniformity of data collection and reporting represents the greatest difficulty in a study of this magnitude, where the collaborative efforts of a number of institutions and the coordinated activities of individuals of many disciplines are involved. In order to insure this essential uniformity, several measures are being used.

1. The study is being conducted according to a single design, and the data collected are assembled, coded, and analyzed within a single central office.

2. Training sessions for participants have been developed, and it is hoped that uniformity may be maintained by frequent exchange of personnel among the collaborators.

3. There is a continuing review of data and procedures by personnel of the central office. However, each institution must be on the lookout for biases, errors, and other inadequacies. These deficiencies, unfortunately, cannot be discovered as efficiently or as rapidly through central-office editing alone. Local editing permits checking for completeness of study forms and accuracy of the interviewer or recorder and affords early detection of consistent errors.

Periodically, the central office compares institution with institution for the percentage of

times a given item on a form is left blank and other aspects dealing with reliability and consistency of data. These comparisons are sent to the institutions so that each can compare itself with the others. Variations may be explained by differences in clinic populations (race, parity, geographic locations, and so forth) or by differences in standards, definitions, and clinical interests. Agreement must be reached among members of a given discipline on standards, definitions, and even abbreviations to be used.

The project director is considered responsible for the accuracy and quality of the data submitted. It is his responsibility to insure that all records for submission to the central office are checked promptly for completeness, legibility, and reliability.

Recently a review of Apgar Scores (a composite score based on an evaluation at a specific time of the neonate's heart rate, respiratory effort, muscle tone, reflex irritability, and color, compared with given standards, some of these components being more objectively rated than others) for 408 neonates from six collaborating institutions revealed a great variation in distribution of scores among the institutions. The least distressed baby could score 10, the most distressed, 0. The great variation in distribution of scores is indicated by the fact that the percentage of neonates scoring 8 or higher ranged from 12 percent in one institution to 84 percent in another. These great differences in score distribution were also evident in each of the five component scores of the Apgar test. Such great variation might conceivably be due to actual differences in neonate populations, but it is unlikely. It is probable that greater adherence to procedure in making the test, such as time after birth at which test was given, inaccessibility to prior knowledge by the rater of the gravida's pregnancy risk, or reduction in inter- and intra-rater variability, can reduce the variation. These and similar analyses will continue to be made.

Concerning validation of data, one of the project institutions has studied the degree to which birth weight information given by the gravida concerning her prior pregnancies compares with birth record data. Additional studies by other project institutions attempt to validate information given by the gravida about her sisters and their offspring, by comparing it with similar information obtained from the sisters themselves. Underway is a pilot study of the actual examination of the relatives reported by the gravida as having neurological disorders to determine over-reporting on the part of the gravida and the extent of inaccuracies in this type of reported data.

It is expected that a number of studies to determine the validity of the gravida's response to questions concerning her medical history, by comparison with records of medical care, will be undertaken with several prepaid health plans. Efforts to validate data will continue to receive urgent attention.

The Results

All records will be machine processed and tabulated centrally. It is planned to prepare a feedback summary statistical report periodically (probably annually) during the course of the study. These reports will include summary tabulations for each institution and for all institutions combined. Because of the complexity of this study and the multitude of variables to be analyzed, it would not be feasible or practicable for these reports to be prepared in great detail. The summary tabulation will be in the form of relatively simple distributions, such as two-way classifications for the items of major importance and interest. No attempt will be made to prepare detailed, periodic analytical reports describing associations or correlations of perinatal events with the development of neurological and other sensory disorders until data on a sufficient number of pregnancy outcomes have been collected to allow meaningful interpretation.

Reports and tabulations prepared periodically will also be used to determine the general distribution of the populations sampled in each institution with respect to the variables under consideration. They will be used, in addition, on a continuing review basis, to point up possible major differences between the institutions, due either to random variation, differences in respect to populations sampled, or differences in procedures, techniques, and methods of data collection. In interpretation of these data, con-

sideration must be given to these possible sources of differences.

This review of the preliminary distribution of data, obtained from the tabulations mentioned above, will, it is hoped, help to determine the most expeditious way of treating and analyzing the data. For example, the observed distribution of the various items can be used as a guide for setting up feasible cross-classifications of items, such as prenatal factors, for analysis and will indicate, to some extent, types of analytical methods and tests to be employed. One possible first approach would be a series of 2 x 2 chi-square tables. This type of massive analysis is now feasible through the use of high-speed computers which permit the otherwise laborious computations of large volumes of data in a relatively short time and at reasonable cost.

In this study it is necessary to determine the incidence of certain types of stress among the newborn through the first several years of life from gravidas with given prenatal conditions or events as compared with those without such conditions or events, controlling as nearly as possible for other relevant variables such as age of mother, race, and previous pregnancies. For example, the mothers will be subdivided into groups according to certain characteristics, environmental, biological, or genetic, which they or their husbands possess, and according to the course of pregnancy, labor, and delivery. The incidence of neurological and other conditions, of pregnancy wastage, and of childhood mortality will be studied in each of these groups. Associations or significant relationships which may be revealed from the analyses may require additional well-controlled studies of a specific nature.

In analyzing the data, consideration must be given to the fact that a large number of variables are being studied. Many of the variables to be studied are not independent of one another, which is a further complication. For these and other reasons, in the process of examining cross-classified tabulations, perplexing questions may arise. To arrive at answers, it may be necessary to employ complex analytical techniques, such as multivariate analysis.

These are some of the methodological issues that face a statistician in collaborative research. While statistical decisions must be uniform for all of the institutions in a study of this type, the application of these decisions and their feasibility may vary from place to place. Practicality may occasionally compromise the difference between what should be done, or the ideal, and what can be done, or the situation as it is.

Finally, a project of this magnitude represents a considerable burden superimposed on routine hospital administration. Under no circumstance can routine administration be disrupted by the study. Consequently, the study must be fitted into the hospital situation as it exists. Since no two hospitals function in the same way, this may, in itself, account for some of the interhospital variation.

One of the most important objectives of this study has been relatively unemphasized, that is, to obtain a greater knowledge of the methods used in conducting such long-term, interdisciplinary, collaborative undertakings. If successful methods can be devised, a completely new and almost limitless area of research will have been opened up, research where the united efforts of many individuals and institutions can be brought together in a common undertaking.

REFERENCE

(1) Lilienfeld, A. M., and Parkhurst, E.: A study of the association of factors of pregnancy and parturition with the development of cerebral palsy. Am. J. Hyg. 53: 262–282, May 1951.

Safety in the Public Health Laboratory

E. B. M. COOK, M.A.

RECOGNIZING the endogenous hazards of public health laboratory procedures, which often involve contact with disease-producing agents, the Texas State Department of Health laboratory section has established a "watchdog" committee on laboratory safety. Its duties are to survey work hazards and accidents and to make recommendations for remedial action. The committee is made up of the supervisors of the three laboratory divisions. Laboratory-acquired infections have received major attention, but other hazards of the laboratory environment have also been studied. Based on committee recommendations, a standard form for reporting laboratory accidents and another for reporting laboratory exposure to or infection with pathogens have been adopted, and an employee immunization program and recording system have been instituted. Based on findings of hazard surveys, several changes in workroom and passageway design have been recommended.

Survey Results

The first hazard and infection survey was made in 1950 to provide information for the Sulkin and Pike questionnaire on laboratory-acquired infections (*1*). Records were available only back to 1930. The second survey was made in 1956, about 2 years before the laboratory moved into new quarters. In these surveys 20 laboratory-acquired infections and 1 infection, rabies, contracted in related fieldwork were tabulated for the period 1930–56. The rabies infection, a fatal case, occurred in an entomologist from the laboratory who was engaged in bat rabies investigations (*2*). He and his associates had banded some 10,000 bats in connection with migration studies. Data on these infections and two others that occurred in 1957 and 1958 before the move into new quarters are summarized in the table.

The laboratory-acquired infections included two cases of an unusual infection caused by a bat salivary gland virus. The bats were autopsied and the brain and salivary gland tissues ground in glycerine-saline and injected intracranially into mice. In addition to recovering several strains of bat rabies virus, several isolations were made of an unknown salivary gland virus, which was later identified as antigenically related to the arthropod-borne group B viruses (*3,4*).

One worker engaged in the bat-screening project was ill for about a week with symptoms of dizziness, paresthesia, and general malaise. Blood specimens showed a rise in the complement-fixing titer for the salivary gland isolates and neutralization index change from 0 to 1:1,000. The other worker had a less apparent illness with some malaise but no distinct symptoms; blood specimens, however, showed a complement-fixing titer rise and a neutralization index change from 0 to 1:80 for the salivary gland virus.

Also of particular interest were six cases of typhus fever probably due to contact with aerosols resulting from processing typhus vaccine. Of the six cases, only two persons were actually handling the agent; the others merely worked in the same area. The one severe allergic pulmonary reaction was thought to be due to direct inhalation of hen's eggshell dust.

The 1956 survey also revealed a number of

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Summary of laboratory-acquired infections in Texas State Department of Health, 1930–60 [1]

Type of infection	Case No.	Year	Proved or probable source of infection	Confirmatory tests	Comment
Bacteria:					
Salmonellosis	1	1944	Worker aspirated highly virulent strain of *S. typhi* into mouth with pipette during typhoid vaccine production work.	Agglutination titer rise. *S. typhi* isolated from blood and stool.	Case nearly fatal. Work loss of 3 months. Worker had had one dose of typhoid vaccine.
Shigellosis	2	1934	Worker accidentally aspirated a culture of *S. alkalescens* while pipetting.	*S. alkalescens* isolated from stool. Had almost pure culture for 4–5 days.	No symptoms. No work loss.
	3	1937	----do----	*S. alkalescens* isolated from stool.	Do.
	4	1954	Worker doing bacteriology on stools. No known accident.	*S. flexneri* 2 isolated from stool.	Severe infection with weight loss of 10 pounds. Work loss of 10 days.
	5	1957	Worker doing bacteriological identification of *S. boydii* 2. No known accident.	*S. boydii* 2 isolated from stool.	Work loss of 1 week.
	6	1959	Worker doing bacteriology on stools. No known accident.	Both *Salmonella* and *Shigella* isolated from stools.	Weight loss. Work loss of 1 week.
Whooping cough.	7	1949	Worker loaded and unloaded shaking machines used to aerate highly virulent liquid culture of *Haemophilus pertussis* used in vaccine production.	*H. pertussis* isolated from cough plate.	No history of disease or vaccine. Work loss of 1 week.
Rabies	8	1956	Worker banding bats in caves. Rabies virus isolated from bats living in these caves. Possible portal of entry of virus was open dermatitis lesions on back of neck which might have been rubbed with gloves contaminated from handling bats.	Animal inoculation of autopsy brain tissue killed mice with typical symptoms of rabies, and Negri bodies were seen in the mouse brain tissue.	Died January 4, 1956.
Bat salivary gland virus.	9, 10	1955	Workers handling rabies-infected bats, removing brain and salivary gland tissues and inoculating tissue emulsions into mice.	Specific antibody titer rise for the salivary gland virus.	Work loss of 1 week.
Vaccinia virus lesion.	11	1945	Worker contaminated fingers with virus while sealing smallpox vaccine glass capillary tubes and scratched a pimple near outer corner of eye. Typical lesion occurred and was in danger of spreading into eye.	Vaccinia virus isolation from typical lesion.	Work loss of 1 week. (At least 10 other workers have had finger lesions of vaccinia from broken capillary tube cuts.)

Summary of laboratory-acquired infections in Texas State Department of Health, 1930–60 [1]—Continued

Type of infection	Case No.	Year	Proved or probable source of infection	Confirmatory tests	Comment
Virus—Continued					
Influenza	12	1958	Worker exposed while harvesting egg fluid from second passage throat-wash specimen. Needle came off syringe and sprayed fluid over nose and mouth; egg fluid showed high titer for A/ Japan/ 305/ 1957 strain.	Acute serum gave 1:20 HAI titer. Convalescent serum rose to 1:160 for Asian influenza.	Work loss of 4 days; had had 1.0 ml. of Asian influenza vaccine.
	13	1959	Worker using live virus influenza antigen for HAI test: pulled fluid up into mouth with pipette. Antigen was strain A/ Denver/ 1/ 1957.	Paired serums showed titer rise from 1:10 to 1:80 for A/ Denver/ 1/ 1957 strain.	Work loss of 2 days.
Rickettsia:					
Typhus fever	14–19	1935–36	Workers exposed to aerosols from various processes in preparation of typhus vaccine and antiserums.	Specific antibody titer rise; complement-fixing titers persisted for long periods.	Two severe cases with work loss of over month each.
	20	1942	Worker bitten by flea from kitten used in infectivity experiments.	Specific antibody titer rise.	Worker well immunized with typhus vaccine. Work loss of 1 week.
Psittacosis	21, 22	1952	Workers exposed while autopsying birds and handling egg embryo infected tissues.	do	Work loss of 1 month and 1 week.
	23	1954	Worker exposed while collecting tissues at poultry plant inspection.	do	Work loss of 3 days.
Parasite:					
Giardiasis	24	1956	Worker checked in several hundred stool survey specimens, stamping numbers and dates on report cards, many of which had been contaminated from leaky containers. Aerosol suspected as the source of infection.	*Giardia lamblia* isolated from worker's stool after typical incubation period and course of disease.	No work loss.
Coccidiosis	25, 26	1959	Both workers working with *Isospora hominis* in isolation, identification, and animal feeding experiments.	*I. hominis* isolated from stools, repeatedly.	Work loss of 4½ days for one worker and none for the other. Both lost considerable weight.
Allergic reactions	27	1948	Worker handling hen's eggs in production of smallpox vaccine developed a pulmonary reaction resembling pneumonia.	Skin patch tests revealed specific allergy to eggshell dust.	Work loss of 10 days. Worker permanently shifted to other work.
	28	1958	Worker handling hen's eggs in production of smallpox vaccine developed a severe case of contact dermatitis on both hands.	do	No work loss, but worker shifted temporarily to other work and had to wear gloves.

[1] One infection acquired in the field (case No. 8).

hazards associated with crowded laboratory workspace and animal quarters and inadequate equipment and safety devices. Serious accidents other than those which caused the infections, included nine severe cuts, two of which required surgical repair and hospitalization, three broken bones from falls on stairways or uneven floor surfaces, and six severe burns, one of which was a facial burn due to an ether explosion fire.

New Laboratory Quarters

With the findings of the early surveys as a stimulus and a guide, safety was a prime consideration in the design of the new laboratory quarters. Above all we wanted to segregate the work with highly infectious pathogens. We also wanted to avoid crowded work areas, to have adequate sterilization facilities, and to provide all practical safety devices.

In the new quarters the work with viruses and rickettsiae is conducted in a separate, specially designed building. The tuberculosis and mycological diagnostic work is done in a specially designed, isolated area. Workspace in every unit is adequate. Animal quarters include a quarantine room, feed storage room, areas and equipment for cage sterilization and washing, and an incinerator for disposal of infectious debris and animal bodies. Bacteriological safety cabinets were installed for work with pathogens. Eye-bath facilities and overhead showers are available near the acid-cleaning sinks for use in case of splash accidents.

A survey by the safety committee in 1960, however, revealed that despite the careful attention given to isolation of work with infectious pathogens and provision of adequate workspace and safety devices, four cases of laboratory-acquired infections and one case of an allergic reaction occurred after the move into the new building (see table). Two accidents were directly responsible for three of these cases. Case No. 13 was due to accidental contamination of the mouth with infectious fluid with a pipette, and No. 25 and No. 26 came from accidental partial strangulation of a rabbit during a feeding experiment causing the animal to cough and spray the parasitic organism into the faces of two workers. These two cases of infection with the parasite *Isospora hominis* are of particular interest because apparently only 400 organisms used in the prepared capsule fed to the rabbit were sufficient to infect both workers at the same time (*5*).

Ten other accidents were noted in the 1960 survey, three of which could have resulted in infections. One of these involved a needle and syringe; another, breakage of an ampule containing a dried culture of *Salmonella typhi;* and a third, the bite of an infected animal. Other accidents included cuts or stabs from broken glassware and wood splinters. One of the wall cabinets filled with glassware fell on two workers (there were no injuries). One accident occurred in the laboratory warehouse. A worker dropped a bottle of sulfuric acid on a concrete floor, splashing the acid over his feet and legs. Prompt washing with large amounts of water and application of basic neutralizers prevented skin damage.

The 1960 survey revealed few hazards in the new building that could not be remedied. Such things as doorstops extending too far into passages, inadequate knee room under worktables, slick spots on floors due to heavy wax concentration, and wet glazed tile floors can be eliminated or the hazards minimized. Safe handling of potentially dangerous materials is a matter for diligent education and supervision.

Safety Administration and Education

Attention to the human element is recognized as one of the most important measures in preventing laboratory accidents and infections. It is essential that the individual worker be alert to the dangers that exist. He must feel responsible not only to himself but to others for developing and practicing safe techniques. Education and training of laboratory personnel toward these ends, we believe, is the most fruitful approach to safety in the laboratory.

In the Texas State Department of Health, general administrative rules and regulations governing laboratory practices are clearly set down. These concern the entrance and exit of materials into and from the laboratories; eating, drinking, and smoking in restricted areas; changes of clothing and showers; procedures to be followed in the event of an accident, includ-

ing decontamination procedures; and entrance of visitors. Specific regulations cover procedures known to be particularly hazardous, such as tissue grinding or maceration, centrifuging of infectious materials, pipetting of infectious liquids, use of hypodermic syringes and needles, drying of pathogens and opening of dried culture ampules, handling of infected animals, and opening of diagnostic specimen containers. There are also regulations governing the handling of poisonous, corrosive, or explosive chemicals.

The Texas State Department of Health conducts an immunization program for all employees in "at-risk" work areas and makes periodic checks of immune status. For example, tuberculin skin testing is done annually on workers performing diagnostic tests for tuberculosis.

Supervisors of the laboratory divisions are responsible for orienting the new employees regarding the rules and regulations, for the general safety education of new employees, and for the enforcement of regulations covering particularly hazardous procedures. The safety education of the employee includes instruction in decontamination procedures to be used in the event of laboratory accidents involving infectious materials or dangerous chemicals. The manual prepared at Fort Detrick has been found to be a helpful reference on microbial decontamination procedures (*6*).

Safety in Animal Handling

Safety in handling of laboratory animals from purchase and quarantine to final disposition is a major concern in the laboratory. Many of the naturally occurring infections of laboratory animals are directly transmissible to man, either through handling of animals or contact with nasal, fecal, or renal discharges, through bites of infected animals, or through contact with infected tissues of animals at autopsy. Perhaps the greatest danger is the inapparent infection that comes to light only when the animal is placed under stress.

To minimize the infection hazard as well as the economic loss from diseased animals, our animals are purchased from local dealers, and the establishments of these dealers are checked frequently. The only exception are the mice used for typhoid vaccine potency testing which are purchased from certain out-of-State dealers because of recurrent *Salmonella* infections in mouse colonies of local breeders.

All rabbits, guinea pigs, monkeys, and dogs coming into the laboratory are held in quarantine for 1 to 2 weeks before they are moved into permanent quarters. They are carefully checked for any sign of illness. The rabbits used for production of rabies vaccine, in particular, are carefully screened for extraneous infections during the quarantine period, since the brain tissue is used directly in the final vaccine.

The laboratory workers are instructed in safety techniques in the inoculation of infectious materials into animals and in the inspection of these animals after inoculation. Such precautions as the use of bacteriological safety hoods for inoculation of animals with tuberculosis specimens are routine practice. After inoculation these animals are held in an isolated unit in the animal quarters. All animals inoculated with viral and rickettsial specimens are also handled under safety hoods and are maintained in animal quarters within the virus building.

The laboratory animal caretakers are also instructed as to safety precautions to be observed in feeding, watering, and handling of animals inoculated with pathogens. They are taught how to sterilize and wash cages and dispose of such animals without hazard to their health. Cage debris and animal bodies are carried directly to the incinerator in closed containers.

Conclusion

Constant attention to the existence of laboratory hazards, orientation and education of new workers in laboratory safety procedures, continued emphasis on safety for old employees, and maintenance of protective immunization for "at-risk" workers, wherever possible, are measures the Texas State Department of Health is stressing in its efforts to reduce laboratory accidents and infections to a minimum. These are the measures recommended by the department's "watchdog" committee on laboratory safety, appointed to survey work hazards and suggest remedies.

REFERENCES

(*1*) Sulkin, S. E., and Pike, R. M.: Survey of laboratory-acquired infections. Am. J. Pub. Health 41: 768–780 (1951).

(*2*) Irons, J. V., et al.: The public health importance of bats. Texas Rep. Biol. & Med. 15: 292–298 (1957).

(*3*) Clarke, D. H., and Casals, J.: Technique for hemagglutination and hemagglutination-inhibition with arthropod borne viruses. Am. J. Trop. Med. & Hyg. 7: 561–573 (1958).

(*4*) Sulkin, S. E., Wallis, C., and Allen, R.: Relationship of bat salivary gland virus to St. Louis encephalitis group of viruses. Proc. Soc. Exper. Biol. & Med. 93: 79–81 (1956).

(*5*) Henderson, H. E.: An outbreak of isosporiosis in a school for mental defectives. (In press.)

(*6*) Practical procedures for microbial decontamination. Frederick, Md., Fort Detrick, Safety Division, September 1956.

Biology and Control of the Cockroach

16-mm. motion picture, color, sound, 489 feet, 13½ minutes, cleared for television, 1960. (Order No. M–426.)

Audience: State, county, and local sanitarians.

Designed to train sanitarians in recognition and control of the cockroach, the film also presents new insecticides for use against chlordane-resistant roaches.

For those who prefer a filmstrip as a teaching aid, No. F–91, under the same title, is available.

Germfree Animals in Medical Research

16-mm. motion picture, color, sound, 19 minutes, 1960. (Order No. M–430.)

Audience: Universities, medical schools, laboratories, and research institutes.

The film demonstrates techniques used successfully at the National Institute of Allergy and Infectious Diseases, Public Health Service, to create a germfree environment, place in it a germfree animal, and maintain the animal without introducing contamination.

Studies underway using germfree animals include host-parasite relationships, nonspecific host defense mechanisms, immunological studies, and role of micro-organisms in oral and dental diseases and in nutritional and metabolic processes.

High-Temperature Short-Time Pasteurization: Inspection and Testing

16-mm. motion picture, color, sound, 907 feet, 25 minutes, 1960, cleared for television. (Order No. M–391.)

Audience: Milk sanitarians, authorities of sanitation policies and programs, sanitary engineers, health officers, undergraduate dairy technologists.

Designed for training inspection personnel in the procedures for testing the functioning and accuracy of high-temperature, short-time pasteurization controls according to the standard milk ordinance, this film supersedes the 1951 film, No. M–10a, of the same title.

Leptospirosis

16-mm. motion picture, color, sound, 596 feet, 16½ minutes, 1960, cleared for television. (Order No. M–329.)

Audience: Veterinarians, physicians, bacteriologists, public health personnel, and undergraduates.

The film is designed to alert physicians and professional personnel to the possibility of human infection, and to acquaint laboratory personnel with the identification, mode of transmission, and other aspects of leptospirosis. Phases of the disease are depicted.

Management of the Leprosy Patient

16-mm. motion picture, color, sound, 698 feet, 19 minutes, 1960. (Order No. M–392.)

Audience: Nonprofessional, suitable for the general public as well as citizen groups. (Physicians are referred to the motion picture No. M–374, "Recognition of Leprosy," which deals with diagnosis.)

Depicting the procedures used at the Public Health Service hospital at Carville, La., in treating and rehabilitating its 260 patients, the film is intended as an aid in overcoming the nonacceptance by society of the discharged patient because of old superstitions and erroneous beliefs that leprosy is highly contagious.

These films are available on short-term loan, United States only, from the Communicable Disease Center, Atlanta 22, Ga., Attention: Audiovisual. They can be purchased from United World Films, Inc., 1445 Park Avenue, New York 29, N.Y.

A Quarter Century in the Natural Sciences

WARREN WEAVER, Ph.D.

SPEAKING ROUGHLY, one may say that the 17th, 18th, and 19th centuries formed the period in which physical science learned how to analyze two-variable problems. During that 300 years, science developed the experimental and analytical techniques for handling problems in which one quantity—say, a gas pressure—depends primarily upon a second quantity—say, the volume of the gas. The essential character of these problems rests in the fact that, at least under a significant range of circumstances, the first quantity depends wholly upon the second quantity, and not upon a large number of other factors. Or in any event, and to be somewhat more precise, the behavior of the first quantity can be described with a useful degree of accuracy by taking into account only its dependence upon the second quantity, and by neglecting the minor influence of other factors.

These two-variable problems are essentially simple in structure, this simplicity resulting largely from the fact that the theories or the experiments need deal with only two quantities, changes in one of which cause changes in the other. The restriction to two variables, and in most cases to simple relations between the variables and their first and second derivatives, kept the theoretical system well within the then analytical and computational capacity of mathematics. Correspondingly, there could be simplicity in the experimental basis; and simplicity was a necessary condition for progress at that stage of development of science.

It turned out, moreover, that vast progress could be made in the physical sciences by theories and experiments of this essentially simple character. The physicists of this period could analyze how the intensity of light varies with the distance from the source; how the strength of a beam depends upon its dimensions or upon the physical properties of its material; how electric current is related to voltage or resistance; how gravitational attraction depends upon distance; how steam pressure is related to steam temperature; and hundreds of other such things. The resulting knowledge made possible great advances in our understanding and control of nature, great practical advances in technology. It was this kind of two-variable science which laid, over the period up to 1900, the foundations for our theories of light, of sound, of heat, and of electricity. It was this kind of two-variable science—or minor extensions of it to handle three or four variables—which brought us the telephone and the radio, the automobile and the airplane, the phonograph and the moving pictures, the turbine and the diesel engine, and the modern hydroelectric power plant.

The concurrent progress in biology and medicine was also impressive, but was of a different character. The significant problems of living organisms are seldom those in which one can rigidly maintain constant all but two variables. Living things are more likely to present situations in which a half-dozen, or even several dozen, quantities are all varying simultaneously and in subtly interconnected ways. And often they present situations in which some of the essentially important quantities are either non-

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quantitative, or have at any rate eluded identification or measurement up to the moment. Thus these biological and medical problems often involve the consideration of a most complicatedly organized whole.

Between the living world and the physical world, moreover, there is a critical distinction as regards dissectability. A watch spring can be taken out of a watch and its properties usefully studied apart from its normal setting. But if a heart be taken out of a live animal, then there is a great limitation on the range of useful studies which can be made.

It is not surprising that up to 1900 the life sciences were largely concerned with the necessary preliminary stages in the application of the scientific method—preliminary stages which involve collection, description, classification, and the observation of concurrent and apparently correlated effects. They had only made the brave beginnings of quantitative theories, and hardly even begun detailed explanations of the physical and chemical mechanisms underlying or making up biological events.

To sum up, physical science before 1900 was largely concerned with two-variable problems of simplicity; while the life sciences, in which these problems of simplicity are not so often significant, had not yet become highly quantitative or analytical in character.

Problems of Disorganized Complexity

Subsequent to 1900—and actually earlier, if we remember heroic pioneers such as Josiah Willard Gibbs—the physical sciences developed an attack on nature of an essentially and dramatically new kind. Rather than study problems which involved two variables or at most three or four, some imaginative minds went to the other extreme, and said: "Let us develop analytical methods which can deal with two billion variables." That is to say, the physical scientists (with the mathematicians often in the vanguard) developed powerful techniques of probability theory and of statistical mechanics which can deal with what we may call problems of disorganized complexity.

This last phrase calls for explanation. Consider first a simple illustration in order to get the flavor of the idea. The classical dynamics of the 19th century was well suited for analyzing and predicting the motion of a single ivory ball as it moves about on a billiard table. In fact, the relationship between positions of the ball and the times at which it reaches these positions forms a typical 19th century problem of simplicity. One can, but with a surprising increase in difficulty, analyze the motion of two or even of three balls on a billiard table. There has been, in fact, considerable study of the mechanics of the standard game of billiards. But as soon as one tries to analyze the motion of 10 or 15 balls on the table at once, as in pool, the problem becomes unmanageable, not because there is any theoretical difficulty, but just because the actual labor of dealing in specific detail with so many variables turns out to be impracticable.

Imagine, however, a large billiard table with millions of balls flying about on its surface, colliding with one another and with the side rails. The great surprise is that the problem now becomes easier: the methods of statistical mechanics are now applicable. One cannot trace the detailed history of one special ball, to be sure; but there can be answered with useful precision such important questions as: On the average how many balls per second hit a given stretch of rail? On the average how far does a ball move before it is hit by some other ball? On the average how many impacts per second does a ball experience?

Two paragraphs back it was stated that the new statistical methods were applicable to problems of disorganized complexity. How does the word "disorganized" apply to the large billiard table with the many balls? It applies because the balls are distributed, in their positions and motions, in a helter-skelter—that is to say, a disorganized—way. For example, the statistical methods would not apply if someone were to arrange the balls in a row parallel to one side rail of the table, and then start them all moving in precisely parallel paths perpendicular to the row in which they stand. Then the balls would never collide with each other nor with the end rails; and one would not have a situation of disorganized complexity.

We can see, from this illustration, what is meant by a problem of disorganized complexity. It is a problem in which the number of variables

is very large, and one in which each of the many variables has a behavior which is individually erratic, and may be totally unknown. But in spite of this helter-skelter or unknown behavior of all the individual variables, the system as a whole possesses certain orderly and analyzable average properties.

A wide range of experience comes under this label of disorganized complexity. The method applies with increasing precision when the number of variables increases. It applies with entirely useful precision to the experience of a large telephone exchange, predicting the average frequency of calls, the probability of overlapping calls of the same number, and so forth. It makes possible the financial stability of a life insurance company. Although the company can have no knowledge whatsoever concerning the approaching death of any one individual, it has dependable knowledge of the average frequency with which deaths will occur.

This last point is interesting and important. Statistical techniques are not restricted to situations where the scientific theory of the individual events is very well known—as in the billiard example where there is a beautifully precise theory for the impact of one ball on another. This technique can also be applied to situations—like the insurance example—where the individual event is as shrouded in mystery as is the chain of complicated and unpredictable events which leads to the accidental death of a healthy man.

The examples of the telephone and insurance companies will suggest a whole array of practical applications of such statistical techniques. But they are in a sense unfortunate examples, for they tend to draw attention away from the more fundamental use which science makes of these new techniques. The motions of the atoms which form all matter, as well as the motions of the stars which form the universe, all come under the range of these new techniques. The fundamental laws of heredity are analyzed by them. The laws of thermodynamics, which describe basic and inevitable tendencies of all physical systems, are derived from statistical considerations. The whole structure of modern physics, our present concept of the nature of the physical universe and of the accessible experimental facts concerning it, rests on these statistical concepts. Indeed, the whole question of evidence, and the way in which knowledge can be inferred from evidence, is now recognized to depend on these same ideas. During the last years we have also come to realize that communication theory and information theory are similarly based upon statistical ideas. One is thus bound to say that probability notions are essential to any theory of knowledge itself.

Problems of Organized Complexity

And yet this statistical method of dealing with disorganized complexity, so powerful an advance over the earlier two-variable methods, leaves a great field untouched. One is tempted to oversimplify and say that scientific methodology went from one extreme to the other—from two variables to an astronomical number—and left untouched a great middle region. The importance of this middle region, moreover, does not depend primarily on the fact that the number of variables involved is moderate—large compared to two, but small compared to the number of atoms in a pinch of salt. The problems in this middle region will, in fact, often involve a considerable number of variables; but much more important than the mere number of variables is the fact that these variables are all interrelated. That is to say, the really important characteristic of the problems of this middle region which science has as yet little explored or conquered lies in the fact that these problems, as contrasted with the disorganized situations with which statistics can cope, show the essential feature of organization. We will therefore refer to this group of problems as those of organized complexity.

What makes an evening primrose open when it does? Why does salt water fail to satisfy thirst? Why is one chemical substance a poison when another, whose molecules have just the same atoms but assembled into a mirror-image pattern, is completely nontoxic? Why does the amount of manganese in the diet affect the maternal instinct of an animal? What is the description of aging in biochemical terms? What meaning is to be assigned to the question: Is a virus a living organism? What is a gene, and how does the original genetic constitution of a living organism express itself in the de-

veloped characteristics of the adult? What happens when previously normal cells suddenly start the uncontrolled growth we call cancer? Why can a salamander regenerate an amputated limb, whereas a man cannot? How does the DNA molecule reproduce itself, and just how does it store genetic information?

All these are certainly complex problems. But they are not problems of disorganized complexity, to which statistical methods hold the key. They are all problems which involve dealing simultaneously with a sizable number of factors which are interrelated into an organic whole. They are all, in the language here proposed, problems of organized complexity.

On what does the price of wheat depend? This too is a problem of organized complexity. A very substantial number of relevant variables is involved here, and they are all interrelated in complicated but nevertheless not in helter-skelter fashion.

How can we compare the social costs and the social gains to be expected from the continuation of atomic weapon testing? What are the total biological dangers involved in man's exposure to all sorts of radiations?

How can currency be wisely and effectively stabilized? To what extent is it safe to depend on the free interplay of such economic forces as supply and demand? Or to what extent must we employ systems of economic control to prevent the wide swings from prosperity to depression? These are also obviously complex problems, and they too involve analyzing systems which are organic wholes, with their parts all in close interrelation.

How can we explain the behavior pattern of an organized group of persons such as a labor union, or a group of manufacturers, or a racial minority? There are clearly many factors involved here, but it is equally obvious that here also we need something more than the mathematics of averages. Indeed if we only could, in the biological field, begin to learn how to deal with problems of organized complexity, then there might be opportunities to extend these new techniques, if only by helpful analogy, into vast areas of the behavioral and social sciences.

By the early thirties it was clear that science had generally effective tools and techniques for dealing with problems of simplicity, and problems of disorganized complexity. Advances falling under these broad categories continued to be highly important and highly desirable; but there was every basis for expecting that these advances would occur without the stimulation of special or additional financial support. Speaking in very broad terms, this meant that man's conquest of physical nature—so large a part of which comes under the two categories just stated—was certain to move forward and in fact with increasing momentum. But was the time ripe for stimulating advances in the more complex, more difficult, and in many ways more critical areas which, although involving many dissectable problems of the two simpler sorts, essentially involved problems of organized complexity? Was the time ripe for an accelerated and deeper attack upon the life sciences? . . .

Separating and Identifying

If biology presents, for the most part, problems of organized complexity, then one must expect any piece of living matter to contain a vast number of individual substances, all tangled together in an intimate interrelation. But this kind of complexity remains a mystery until one can, in some way, untangle the mess, separate out parts that are themselves homogeneous, and find out what these separate parts are. So separation is a basic procedure in attacking biological problems. . . .

That wise applied biologist, the gardener, preparing his potting soil, puts it through a screen to separate out the pebbles and the weed roots. Screening—or its finer form, filtration—has been useful to the sanitary engineer, and to the biologist also. But it illuminates the character of recent biological advances to remember that a quarter century ago the name "filterable virus" was used precisely to emphasize that one was dealing with an infective agent which would pass right through the filters which successfully screened out bacteria. At that time the virus particles remained unseen—now we take them apart and put them together again!

Thus first in our list of newer methods of separation we should note the improvements in

the ancient procedure of screening. Modern science and technology now makes available cellulose ester filters of remarkable porosity (up to 80 or even 85 percent) with a range of carefully controlled pore sizes. One can have pores of five, or three, or one, or one-half of a ten-thousandth of a centimeter, to use with bacteria; or even pores as small as a millionth of a centimeter to use with viruses; and in all of these the variation in pore size need be only about 10 percent.

The centrifuge, familiar to the dairyman who separates the cream from the milk by utilizing their difference in density, has been developed over the period under review into a most powerful tool for separating out the various component particles, differing in density, which are suspended in or go to make up a liquid. . . .

Ultracentrifuges are now produced in several places in the world. The most advanced American model, not very much larger than an old-fashioned upright piano in size, is an instrument of great precision and delicacy, which has been engineered to dependability even when used by nonspecialized operators.

Although the technique of high-speed whirling is quite different, being produced by a combination of electrical and magnetic effects, the mass spectrometer is in reality a close relative of the ultracentrifuge, separating and identifying the various atoms of different weights in a mixture. It has been used in studies of respiration, and is invaluable in connection with biological tracer experiments which utilize stable, rather than radioactive, isotopes. . . .

For two things to be separable from each other, they have to differ in some way, and this difference must be exploited as a sort of handle which permits the scientist to pick up the one and leave the other. Size is such a difference, and furnishes the handle for filtering methods. Density is such a difference, and furnishes the handle for centrifugation. But a difference which can be variously exploited, which is capable of very delicate discrimination, and which is related in a revealing way to the nature of the thing being separated, is furnished by electrical properties such as charge, distribution of electric charge, magnetic strength, and so forth.

One such method, useful both for identification and separating, is the modern procedure of electrophoresis. The basic principle is an old one, and is due to observations made in 1809 by the Russian physicist F. F. Reuss. But the modern development dates only from the mid-thirties, and is due very largely to the brilliant researches of the Swedish physical biochemist, Arne W. K. Tiselius.

If a conducting liquid, containing several or many kinds of permanently suspended colloidal particles, is located in a horizontal tube, and if an electrical potential difference is established between the two ends, then there is a voltage gradient at every point in the liquid that urges charged particles to drift in the liquid, the force being the larger, the larger their charge. By taking a suitable type of photograph at a suitable time one observes the whole range of kinds of particles, separated out in bunches like the slower and faster horses at the finish of a race. It will of course be recognized that this is a very crude description. In the course of years of experience and of instrumental development, electrophoresis has come to be a method of very great power and usefulness.

An extraordinarily useful and interesting set of procedures which involve identification, although normally not separation, depends upon the obvious fact that tiny experimental creatures such as bacteria or fungi are available in large, willing, and rapidly replenished numbers, and upon the further not at all obvious fact that they have chemical skills which no human chemist possesses.

If, for example, one studies a large number of micro-organisms (the red bread mold *Neurospora crassa* is a now classic example, although the method is only about 20 years old) some of these turn out to be mutant strains, this meaning that one of the creature's genes has become altered. According to the present view, certain genes are responsible for the possession by the organism of certain enzyme systems; and in some instances at least, one gene controls one enzyme. If this gene is altered, the mutant strain of the fungus would lack that particular enzyme.

Now this tiny and lowly creature, in order to live, carries out a great many chemical tasks.

It can take a number of relatively simple chemical substances and link them together into some larger and more complex substance which it requires; or it can take large and complex material which is unusable in its complete form, and split it up into useful parts. Each one of these individual steps of joining or splitting is activated by one special enzyme. Whereas a human organic chemist can carry out multitudes of chemical reactions, an enzyme system (generally speaking) can carry out only one specific chemical operation. But it may be a job which no human chemist can do; and it is, moreover, easy to exploit the fact that each enzyme is such a specialist.

For suppose one has produced (by irradiating with X-rays, for example) a lot of mutant strains of *Neurospora*. Suppose these have been sorted out, and a strain isolated which cannot live unless the food furnished to it contains a supply of, say, the B vitamin thiamine, whereas the normal strains do not require thiamine since they possess an enzyme which is a specialist at making thiamine from other material.

This thiamine-requiring mutant strain (which incidentally breeds true so that it can be maintained in the laboratory) is now ready to go to work for the scientist. If he has a sample of mixed-up material, and wants to know whether or not it contains thiamine, he merely introduces the sample into a thiamine-lacking food supply and offers it to the mutant strain. If the fungus prospers, then the mess contained thiamine; otherwise, not.

A single example of this sort is likely to sound like a tour de force; but actually there are numerous and highly useful ramifications of this general technique. The chemist has, for example, isolated and purified enzymes; and he can then himself use one of these to split some large and complex molecule, confident that the precise inanimate specialist he is using is carrying out the operation in just that one place, in the whole structure of the molecule, where it is known to be able to operate. . . .

Before closing this section on separating and identifying we must pay tribute to one of the most dramatic successes of this period—the development of chromatography. This is in fact a kind of screening procedure, so that in a very broad sense we return to the topic which started this section. But the screening, here, does not depend on size.

Just over 50 years ago a young Russian botanist, Michael Tswett, found a way of separating out the various pigments of a green leaf. He packed a fine, white powder (usually calcium carbonate) into a vertical glass tube, poured into the top of the tube a petroleum ether extract obtained from mashed-up green leaves, and let this complex mixture seep down into and through the tube. The marvel was that various components of the pigmented mixture—components of different shades of yellow, orange, orange-green, and so forth—separated out and produced, on the previously pure white column, a Roman stripe pattern of various shades and colors, each layer of the striped pattern having a sharp boundary. The whole core of the tube could then be pressed out and sliced up into the various layers, from which the separated-out fractions (in this case the various types of chlorophyll pigment) could be dissolved. Subsequent evaporation produces the material in crystalline form—the chemist's hallmark of purity.

This amazing discovery was used only a few times between 1906 and the beginning date of this review; but chromatography, in its present greatly improved forms, is now one of the most powerful tools in the hands of the chemically minded biologist. It promptly turned out that this method of separation, almost mysterious in its simplicity and its ability to deal with complex mixtures which defy ordinary chemical means, was not restricted to colored dyes, but could be used for a wide range of materials. It can be used not only for liquids or dissolved solids but also for gases, and this rather recent extension of the method has proved specially valuable. It is so gentle a procedure, chemically speaking, that it can handle very unstable and elusive substances, this being a great advantage to the biologist.

Extremely clever automatic devices have been developed to collect the various fractions of a complex mixture as they drip out, one after another, from the bottom of a Tswett column.

British workers, 14 years ago, perfected a simplified method. A drop of the mixture to be separated is put on one corner of a vertically

suspended sheet of special filter paper, and the adjoining horizontal edge of the paper is placed in contact with a suitable solute. As the solute spreads out, like moisture spreading in a sheet of blotting paper, the soluble fractions of the drop mixture move in the dampened paper (just as the fractions move in the dampened column of the original method), coming to rest in different places to form a vertical line of spots. The separation of the spots occurs because of the fact that the different fractions move with differing speeds. The sheet is then turned through 90°, and the then horizontal edge next to the line of spots is brought into contact with a second solute. Again the solute spreads, and the soluble fractions of the mixture move, again at varying speeds, coming to rest in a pattern which now extends over the entire sheet of paper. The paper, after it is dried, is then sprayed with some chemical that makes visible (colored) the various spots, or the paper is viewed by ultraviolet light; and the net result is a two-dimensional set of colored spots which visually exhibits the recipe of the original mixture, telling just what constituents it contained.

In a brilliant modification, developed by Melvin Calvin, a complex mixture containing certain molecules labeled with radioactive atoms is separated by the two-dimensional paper method, and the dried chromatogram is then placed in contact with X-ray film, for 2 weeks or so. The radioactive spots affect the film, and, so to speak, "take their own picture."

The method can be used with as little as a fraction of a milligram of material, and tricks have been developed which make possible not only separation and identification, but also measurement of the amount of each constituent. . . .

New Ways to See

Even more spectacular than the new ways to separate are the developments which give the biologist new ways of seeing; and among these the most obvious and also one of the most important is to be found in the modern improvements in microscopy. . . .

The limitation of the ordinary light microscope can be relieved somewhat by using ultraviolet light, since it has a wavelength about half that of ordinary visible light. In the midthirties the uv microscope was being perfected, especially by Swedish workers, and it did reveal details about twice as fine as those which could be studied previously.

But the great advance in resolution—which is the technical term for the capacity of a seeing device to discriminate fine detail—came from the development of the electron microscope. Utilizing the fact that electrons behave like light of wavelength less than one-thousandth that of ordinary light, instruments have been developed which can handle detail down to a ten-millionth of a centimeter. This whole instrumental development has occurred over the period here under review. . . .

Since that time the "e. m." has become such a generally useful and standard device that it goes by this familiar nickname; and the present pattern of use is not a single instrument for a university, but often two or more for a department. Only a few years ago a resolution of 50 Å (an Ångstrom is one hundred-millionth of a centimeter) was considered excellent, and there was in the whole world only one manufacturer of electron microscopes. Now these devices are made not only in the United States but also in England, Holland, Germany, and Japan. It is understood that the Japanese instrument is now guaranteed to give a resolution of 10 Å, this being at the level of size which begins to deal directly with the largest molecules. This resolution is also achieved, under optimum circumstances, with other makes of instruments. . . .

There are still further variants such as the reflecting microscope; fluorescent microscopy; the "flying-spot" microscope which can scan living material with ultraviolet light, pausing such a short time at any one place that the specimen is not killed; and the linking up of microscopy with the picture tube of television, so as to obtain a large image that can be seen by many persons at once. . . .

Still more indirect ways of "seeing" have been developed in recent years. One of these is the method of X-ray and electron diffraction. Suppose that every person who goes through the main concourse, upper level, of Grand Central Station in New York City carries a lighted

candle; and suppose that a large camera, located in the ceiling and pointed toward the floor, records the path of each one of these spots of light but shows nothing else. If the exposure were kept up until many hundreds of persons—light tracks on the film—had passed through, then by studying this film one could deduce that in the center of this great concourse is a special impenetrable region, whose size and shape would become more and more definite as more and more light tracks were photographed. Certain light spots would go up to this region, and then start off in other directions. Other light spots would veer around this region; but none would go through this region. Gradually, as the evidence accumulated, a person who has never been in Grand Central Station, who has seen only these photographs of light tracks, would begin to "see" the size and shape of the information booth in the center of the concourse.

In a way which is only very roughly similar, a scientist can take an unknown structure built out of atoms, pass through this structure a very large number of light particles (X-rays) or electrons, make a photograph which shows the pattern in which the light particles or electrons emerge, and then in a very complicated, very tedious, most ingenious way, he begins to get ideas about the details of the structure through which the light particles or electrons have passed. He has a much harder job than our cameraman in Grand Central. He does not have a picture of the lights going through the structure, but only the pattern in which they emerge; and he is dealing with a three-dimensional structure which may easily contain thousands of atoms, each of which must be located. He cannot, by any rigorous and straightforward way, calculate what that structure is. He can only get hunches of what it might be; and then rigorously calculate what effect this assumed structure would have on a lot of light particles passing through. Only by an incredible miracle would the first hunch turn out right; so there must be months or even years of trial and error. The organic chemist, the biochemist, and the physical chemist help him a great deal, telling him how many of what kinds of atoms he is dealing with, discouraging certain guesses which they know to be unlikely, suggesting certain guesses which their chemical knowledge makes probable. And out of all of this, with skill and art and patience, with inspired guess and with laborious check calculations, using all the aid that can be furnished by modern computing devices, comes an eventual knowledge of the detailed arrangement of the atoms which make up the structure which has been under study.

The culmination of this is a three-dimensional drawing of the structure. The X-ray diffraction or the electron diffraction expert has succeeded in "seeing" the structure—but in how indirect and sophisticated a sense! . . .

These remarks have by no means exhausted the ways, either unknown in 1932 or at least greatly refined since then, which enable the present-day scientist to "see" the revealing details, down to the molecular or even atomic scale, of the structures which are important to the biologists. The very recent methods of nuclear paramagnetic resonance and electron spin resonance are in essence spectroscopic procedures; but have the great advantage to the biologist that information can be obtained about the free radicals in wet biological material.

The labeling of compounds with radioactive isotopes enables the scientist to trace them as they move about in a biological system, sometimes actually by hearing them as they produce clicks in a counter, and sometimes by "seeing" them as they register their positions on a photographic film through autoradiography. In a somewhat similar way it is possible to stain antibodies with a chemical which fluoresces when ultraviolet light impinges, thus making the antibodies visible through photography. Seeing, incidentally, has been greatly improved by the development of photographic emulsions of great speed, finer grain, and sensitivities to various forms of energy which do not directly affect the human eye but which are made humanly visible by the photochemical reactions in the emulsion. The way in which light is scattered by particles of various sizes, shapes, and electrical properties has been most usefully exploited to enable us to "see" these sizes and shapes. And modern electronic techniques have been used to intensify weak optical images, such as might be pro-

duced in the X-ray of a difficult region, to reveal otherwise invisible detail.

A great many of the newer tools of the biologist come under the headings we have already considered, of separation, identification, and seeing; but there are additional ways in which the chemist, the physicist, the engineer, and the mathematician are aiding in the exploration and analysis of living matter.

The more modern aspects of this service began less than 40 years ago when Pregl developed methods for the microchemistry of organic compounds. These classical microchemical methods are able to accept a bit of matter only a millimeter in dimension and only a thousandth of a gram in weight, and determine the sorts and amounts of the individual chemical compounds it contains. But under the demands of present-day biology (and also through the work of the chemists who are associated with atomic and nuclear researches, and who also have to deal with very small amounts of material) it is possible to carry out limited chemical analyses of samples which measure not a millimeter, but a tenth or even a thousandth of a millimeter, and whose weight is not a thousandth of a gram, but a millionth of a gram. Indeed some sort of estimates of chemical composition can be made on samples even smaller than this. . . .

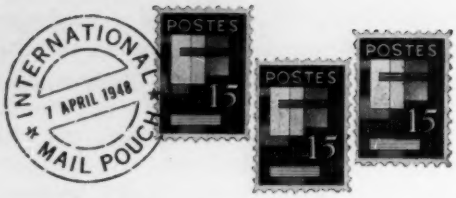
It is of the most characteristic significance, relative to the movements in modern biology, that in many instances the underlying facts are now being successfully explored at the submicroscopic scale of molecular and even atomic dimensions. Biological ultrastructure has become a recognized and rich field. For several years now a term has been used, seriously and in an operational sense, which in 1932 would have been used only with imagination and hope—molecular biology.

A great deal of the information about biological material at this new scale of smallness consists of knowledge about structure. This knowledge has to a great extent been made possible by the procedures and instruments which have been reviewed in the preceding sections. The organic chemists interested in natural products, the physical chemists interested in macromolecules, the specialists in X-ray and electron diffraction, the micro- and submicroanatomists, the molecular biologists, the ultramicroscopic cytologists, the physiologists and biophysicists concerned with life at the smallest scale, the electron microscopist, and many others have all played essential and often interlinked roles in developing the new knowledge about the ultrastructure of living material. . . .

For centuries it has been considered that physical nature is orderly, that it is subject to discoverable laws, and that it may be brought under a considerable degree of control through the study of its problems of simplicity and its problems of disorganized complexity. But it has not only been recognized that the phenomena of life present problems of organized complexity; it has also been considered by many that these phenomena of life are, in some dark and foreboding way, irrational. Indeed, some have gone even further, and have believed that vital phenomena are not only inaccessible to scientific investigation, but are improper and impious objects of any such attempt. This is an old attitude, which centuries ago forced the Italian anatomists to steal corpses in order to carry out their studies.

Even during the magnificent progress made in the last century by the medical sciences, there continued the attitude that certain gross and relatively simple disorders of man were analyzable and curable; but that man as a conceiving, childbearing, thinking, remembering, behaving, growing, and finally dying organism presented problems that were in large part outside the range of rational analysis. The last quarter century has seen a considerable reversal of this view.

We can be well satisfied if this Program in Experimental Biology of The Rockefeller Foundation has helped in a small way to demonstrate that the living world, in its most intimate details, exhibits discoverable rationality and orderly beauty; and that the tools of science are just as effective here as they have proved to be in the purely physical world. Indeed one no longer wishes to insist that man is alien to the universe in which he exists. It involves no belittlement of his higher self to recognize that his body is brother to the molecule and the star.



Carabao Cart to Tractor

Many municipal public health officers in the Philippines are beset with complaints about uncollected and spilled refuse, odors from rotting garbage, flies and rodents near open dumping areas, and smoke from refuse burning at dumps. The complaints stem from improper storage of refuse at collection points, obsolete vehicles or lack of vehicles, and faulty disposal methods.

Cities which have won prizes during National Clean-up Week, observed annually for the last several years, are those which have developed effective and sanitary refuse disposal. Baguio started incinerating refuse a number of years ago and in 1959 began using sanitary landfills to get rid of excess waste and reclaim land. The city of Cavite contracted for the task, after competitive bidding, and now enjoys daily collection service at half the former cost.

To encourage other municipalities, the International Cooperation Administration is providing technical and commodity assistance to demonstrate how refuse can be disposed of successfully and economically. To augment their present 15-year-old equipment, each of two small cities has been given a 10-cubic yard compacting type truck and a crawler-tractor with bucket loader and dozer blade to operate a sanitary landfill. To qualify for the assistance the communities had to provide sufficient refuse receptacles, make collection service systematic, and pass the ordinances necessary to improve their sanitation services. In three smaller communities without organized collections or only carabao carts, small 3-wheel vehicles of Japanese manufacture are being tried. They are successful when loads are light and the streets are narrow.

Composting as a method of disposal has attracted interest, particularly in agricultural areas where chemical and organic fertilizers, imported from Japan, are used. In Manila, a pilot composting plant designed to handle 10 tons of raw refuse a day has been completed with local funds and technical assistance from WHO and ICA. Visitors came from many parts of the country to see it even before it was put into daily operation.

In Dagupan and Cabanatuan, cities of 32,000 and 47,000 population, respectively, two composting plants that will process 25 tons of refuse daily are being built in 1960 and 1961. ICA is supplying each plant with $35,000 worth of mechanical equipment not available locally. The cities are acquiring the land, supplying labor and construction materials, and will finance the costs of operations and maintenance.

Both cities are near farm areas. If the product can be marketed for 11 Filipino pesos per ton, the operation will be self-supporting and the mechanical equipment amortized over a 7-year period. If these two subsidized operations prove economically feasible, private firms are prepared to build similar plants for a number of other municipalities.

—Lloyd Florio, M.D., *chief, health division, U.S. Operations Mission, Republic of the Philippines.*

Along the Maroni

Eradication of malaria is particularly difficult along the Maroni River, the border between Surinam and French Guiana. Spraying in the bush hinterland has not sufficed. Indian dwellings in the area have no sidewalls, and mosquitoes are never found on the roofs or ceilings. After feeding, the vector supposedly leaves the shelter and is not exposed to insecticide. Also, the Indians often leave their villages for periods up to a year to visit tribes in Brazil, and Bush Negroes along the river may stay for months at a time at hidden farm plots far from their villages. Some have five or six widely scattered houses, but only one is known and sprayed.

WHO malaria workers in Surinam and workers from the Pasteur Institute in French Guiana met in St. Laurent early in 1960 to coordinate the campaign along the river and the islands. They agreed to intensify efforts to locate hidden dwellings so that spraying may approach 100 percent coverage in Surinam, where the campaign is in the attack phase. In French Guiana, where malaria has been greatly reduced in 10 years, the surveillance phase has been reached.

—Saul Ruby, M.D., *chief public health officer, U.S. Operations Mission, Surinam.*

Maryland Citizens in Action for Community Health

J. HOWARD BEARD, M.D., M.P.H., and MARGARET C. WOHLGEMUTH, R.N.

A LOCAL demonstration in Anne Arundel County, Md., of how citizens may directly develop public health services, reported in detail in 1954 (*1*), appears 6 years later to have been confined to this area. Although lay health associations are active elsewhere, as in Essex Junction, Vt., none have been found, after extensive inquiry, which show the distinguishing marks of those in Anne Arundel.

In essence, the county is distinguished by the presence of 10 active lay health associations, combined in a county lay health council, each with its own health center. Nine of the local associations own and maintain the structure and facilities of their health center for use by the county health department. They contribute not only their own funds for this purpose but their own labor. Much of the masonry of one center was laid by a mother of four children who played at the site while she set the concrete blocks.

Graduate students of public health from Johns Hopkins University, nursing students from the University of Maryland, Catholic University, and Church Home and Hospital, Baltimore, visitors from many other parts of the world, and delegates to public health conferences have been exposed repeatedly to the program in Anne Arundel. But it does not appear that the spirit here has been infectious.

Earlier reports, including a limited edition of the history of the Lay Health Council of Anne Arundel County, prepared by a committee chaired by Mrs. Frank G. Baldwin, indicate that there is nothing unusual about the setting, the agents, or the hosts of Anne Arundel.

Although the county recently celebrated its 300th birthday, its institutions and people are straining as are most other American communities from technological change and population growth. The county contains all segments of the income curve, landed gentry, a thriving middle class, and a mosaic of minorities. It is predominantly rural-suburban (population, 204,855 in 1960), with opulent estates and abundant recreational and resort areas, and is devoted to fishing and tobacco farming. Nevertheless, the county shares with other communities, the influence of large military bases, unfamiliar industrial installations, trunk highways, and urban metastasis. The county seat is Annapolis, State capital and harbor of the U.S. Naval Academy. The churches, service organizations, and voluntary associations do not differ conspicuously from their counterparts elsewhere. Yet it is not clear that the ferment of change had as much to do with the phenomenon of lay health associations as the ancient traditions of the Free State.

Histories

Oddly enough, no two associations or centers in Anne Arundel County have quite the same history of incentives, sources, or growth. They resemble each other only in the charters of the associations, which are fairly uniform.

The ambitions of private associations of citizens to build their own health centers, as they

Dr. Beard is deputy State health officer and county health officer, Anne Arundel County, Md. Miss Wohlgemuth before her retirement was supervisor of nursing services, Anne Arundel County Health Department.

might build a church or a library, did not flame up like a grass fire. The spark glowed fitfully in the Glen Burnie community before 1925, when the board of education found space for a clinic in a school. This service moved later to a community hall, and then to a volunteer fire station. Even though the health program had a broad range of local citizen support in the years that followed, the health association, with plans for its own building, was not organized formally until 1948.

What was apparently the first association to establish its own quarters, at Owensville, fell to trouble and was evicted in 1936. In 1937, Mrs. Sylvester W. Labrot, Sr., at her own expense, established a health center which she named for the community of St. Margaret's. The association which now maintains the center did not organize until 2 years later. This pioneer center is the only 1 of the 10 still privately owned. Mrs. Labrot and the public health nurse began by gathering clothing and shoes for ragged, hungry children. The Labrot's demonstration dairy provided 5 gallons of milk a day, poured directly from the can, for school lunches. But the flavor of charity was avoided. Believing that people, given guidance, will do for themselves what they want, Mrs. Labrot aimed at helping her neighbors to help themselves.

Seeing the improvement in the condition of the children, Mrs. Labrot concluded that parents could learn to give their homes and children better care, to plant gardens, and to grow and preserve fruits and vegetables. Through the health center, with a nurse and part-time physician on duty, it was possible to operate clinics where lessons of health could be learned and where patients could be screened for communicable disease, notably syphilis and tuberculosis. At the same center, nutrition was improved through canning lessons and other demonstrations of home economics by the county agricultural agent.

For a time, Mrs. Labrot paid the salary of the nurse, in addition to providing the building and its maintenance and the use of a car, with the understanding that other health services could be provided by the county health department.

Through their churches, schools, and farm associations, and through personal visits by the county nurse and volunteer workers, the Negro families of the community organized to come to the center on a systematic basis. Some of the original volunteers are still active in the lay health association after 20 years.

The sponsor of the center also stimulated participation in the health program by offering awards for families with the greatest improvement in the home, pantry, garden, and flower cultivation. Prizes given out at the country church fair aroused in the community at large a sense of the possibilities of a healthier life, through voluntary efforts aided by county government.

The example of St. Margaret's community efforts has since been followed in other areas. With the building at St. Margaret's as an example, Dr. William J. French, county health officer, and Margaret C. Wohlgemuth, public health nurse, in 1937 encouraged the people at Magothy to organize a lay health association. Inside of a month, the maternal and child health clinic at Magothy was able to move from the crowded home of a midwife on Mountain Road to its own quarters, an empty store, since purchased and enlarged for the association's own health center.

The organizing meeting at Magothy took place because the crowds around the home of the midwife attracted the attention of kindly women from Gibson Island. The South Shore group began with clinics held at the State mental hospital at nearby Crownsville.

Modern Pioneers

In the Annapolis health center are the precursory objects of a Hall of Fame. One, a bronze tablet honoring Margaret C. Wohlgemuth, P.H.N., as first public health nurse; another, a communications system, a tribute to William J. French, M.D., health officer; still another, a waiting room for children provided by Mrs. Zell Garner Jones, an outstanding lay participant.

These objects give perhaps a hint of the wisdom and enthusiasm of the personalities that helped spark the organization of 10 voluntary health centers in a single Maryland county.

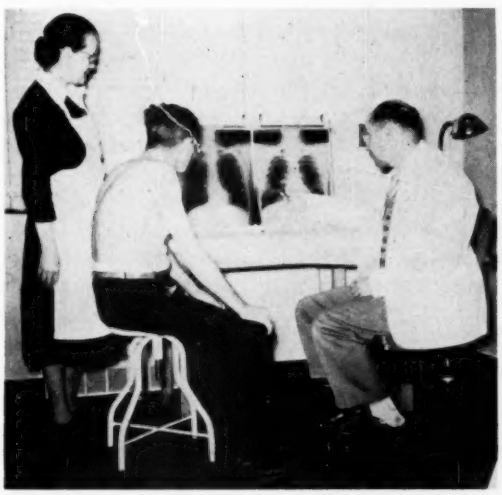
The center at Annapolis began with a donation of $1,500 by the Women's Club for furniture, shortly after the formation of a public health lay council. The authors, the president of the Brooklyn Park Health Association, and the superintendent of schools promoted the health center at Brooklyn Park, which operates in a wing of the high school. In Parole, the lay health association was formed in 1941, only after the parent-teachers association and county health department had maintained a health center for 5 years in the Asbury Methodist Church and later in the parsonage and church hall of the Mount Olive Church.

At Linthicum, a growing population obliged those who had been served at Glen Burnie to organize their own service, beginning with two rooms in the office of a coal company.

The struggling association which survived the eviction at Owensville was given a boost by the Lions Club, following a typhoid fever incident which prompted 600 to seek immunization at one time. Before that crisis, clinics in the sparsely populated region had been held in 10 separate "country store" areas which the residents did not identify as their own. Most have since joined the Southern Anne Arundel County Health Association, which maintains its own building. Its address has been changed from Muddy Creek Road to Shady Side Road.

The Odenton center is the only one to enjoy both military and industrial support. When this clinic was still operating in the basement of a school building, it was one of a number of community bodies which received a cash Christmas gift from a plastics manufacturer who had recently opened a plant in the community. After members of the lay association visited the president to report how they had used the gift, he became so interested that he immediately arranged to install a heater for them, and eventually took on the entire expense and responsibility of building a new center on land donated by another friend of the association. His employees now enjoy the services of the center, as do the dependents of many Army men stationed nearby at Fort George G. Meade.

St. Margaret's Health Center



State medical director of tuberculosis hospitals assists in diagnostic services at Annapolis Health Center clinic

Organization

All the health centers except St. Margaret's have been incorporated. One or two obtain support from community chest drives, but most are financed independently by dues, tag days, raffles, fairs, suppers, and similar money-raising events. All but one center are owned free and clear.

The one stipulation for county use of these voluntary health centers is that they must have a local supervisory and management board. All have title vested in the voluntary associations except the original St. Margaret's. All

have been built by funds, materials, or labor contributed locally. Only the county health center at Annapolis has been constructed with the aid of Federal funds.

There is no fee for service at any health center; it is available to all residents. But donations are occasionally given in appreciation for assistance. Many who receive services join the local health association, as dues are only $1 a year as a rule.

Leaders of the association have few rewards but the satisfaction of their services. Morale is sustained in part by pins or emblems, by newspaper and broadcasting publicity, and by occasional public expressions of appreciation.

County Council

In 1946, the associations formed a county lay health council to exchange information and aid.

Analysis of health centers of the county lay health council, Anne Arundel County, Md., by nursing districts

Health centers by nursing districts	Membership in health associations supporting centers		Estimated capital value	Annual maintenance cost [1]	Staff	
	Total	Active			Public health nurses	Part-time physicians
First (65,534)						
Brooklyn	400	40	$51,000	$1,830	2	6
Linthicum	183	15	20,000	700	3	6
Glen Burnie	60	25	65,000	1,800	[2] 5	11
Second (34,935)						
Annapolis [3]		50	425,000	([4])	[5] 4	15
Parole [6]	80	30	25,000	2,000	2	3
Third (10,790)						
Churchton	100	25	20,000	600	2	3
Fourth (29,094)						
Odenton [6]	40	12	50,000	1,500	3	7
Fifth (29,630)						
Magothy	60	25	17,000	1,200	4	4
Sixth (12,532)						
St. Margaret's [7]	15	10	15,000	600	2	4
Seventh (6,710)						
Davidsonville-Mayo	45	25	10,000	540	2	4
Eighth (10,755)						
South Shore	50	30	15,000	1,200	1	2

[1] Includes heat, light, telephone, janitor services, insurance, and minor repairs.
[2] 4 full-time; 1 part-time.
[3] There is no formal health association. The county lay health council has its headquarters here and the center is staffed by volunteers, either interested individuals or recruits from women's organizations comprising the council. The center shares space with the welfare department and the county laboratory.
[4] Tax supported.
[5] 3 full-time; 1 part-time.
[6] Member of community chest.
[7] Individually owned.
NOTE: Figures in parentheses in stub column are approximate populations of nursing districts.

Association members help build South Shore Health Center

Infant care course for expectant mothers, sponsored by the South Shore Health Center

One of the council's activities is to organize the sale of tags on Child Health Day to obtain vitamins for infants, preschool children, and maternity patients. The tags are distributed to centers for this purpose, but while not all centers participate in this sale, all contribute an amount toward the sale.

By tradition, the children in Glen Burnie hang baskets of paper flowers, made with their own hands, on the doors of people who have donated to the community health fund. Of $2,000 raised by this method in 1 year, the Glen Burnie health center gave $100 to the county lay health council in lieu of selling tags. The council receives donations also from other sources.

Another activity of the council is to pay for part-time nursing services in the absence of a regular nurse, who may be on leave on a scholarship. The council has offered to return tag day proceeds to centers which are pressed for funds, but the offer has continually been rejected.

Typically, a center's health association meets once a month. The county lay health council meets less often, and rotates the meeting site among the health centers. Its board of directors convenes the third Wednesday of every month.

Discussion

In these histories, it is evident that certain specific factors were at work. The need for public health services asserted itself in 1924 with appointment of a part-time health officer and two public health nurses for full-time service in the county, financed jointly by the Maryland State Health Department and the county education department.

The services and information provided at clinics for children stirred enough demand to achieve appointment of a full-time health officer in 1930, Dr. John H. Janney. Dr. Janney and his successor, Dr. William J. French (1936), and the director of public health nursing, Miss Wohlgemuth, were called upon for advice wherever the health associations formed. It was the policy of Dr. Janney and Dr. French to decentralize health services and to encourage lay participation in the maintenance and management of health programs.

Curiously enough, the inspiration of the health centers, St. Margaret's, is the only one to have had strong individual leadership. Since then, their development has been largely an expression of common ambitions in the community.

In each instance, a public health nurse has provided the stimulus. With the example of her work in the county, it usually became evident that health services of a better quality and quantity could be achieved in a permanent center with facilities for examination and instruction. It was almost automatic at that point for volunteers to begin to talk about establishing a health center, however modest. Though the originators of the movement were

usually women, they lost no time in bringing in men, if only to handle the heavy work.

Individual members usually become roving salesmen for the organization. Although interest fluctuates according to the pressure of events in the community, all centers have a loyal continuing body of supporters. It is not the aim of the organization to organize mass meetings, but to keep active a working body of interested leaders.

Another factor was that improvement of family incomes after 1936 encouraged people to establish their own public health centers.

The centers do not compete with the private physician. Rather, the center and the physician enjoy reciprocal advantages. The centers with their facilities, health programs, and equipment help to attract private physicians to rural areas. The services at the center are diagnostic and educational, rather than therapeutic. On the other hand, services provided by the county health department at the centers are regularly assisted with voluntary services by local physicians, who receive a fee for each clinic held.

While the county medical society takes no official part in the activities of the centers, individual physicians are among the most influential supporters. Since it is not the function of the centers to provide therapy, the private physician is a necessary adjunct to the education and screening services developed by the county health department at the centers.

The citizens of Anne Arundel County and their public health officials have, through their concerted efforts, provided health services that have gained wide recognition. Since 1952, new health centers have been constructed at Davidsonville-Mayo, Brooklyn Park, and South Shore; the health services have expanded considerably in response to public requirements; and citizen participation has developed ever more broadly.

Although behavioral research suggests that people tend to act in concert with their neighbors, neighborhood associations do not ordinarily play a positive role in a public health program. According to some observers, the popular image of the health department is someone doing something for or to somebody, not with somebody. It is difficult therefore to explain why lay health associations have developed in Anne Arundel as in so few other places.

The secret lies somewhere between the county health department headquarters in Annapolis and the homes of the farmers and fishermen and factory workers and their kindly well-to-do neighbors, all of whom have worked to build the health centers, often literally with their own hands.

REFERENCE

(*1*) French, W. J., and Beard, J. H.: Citizens take hold. Children 1: 57–63, March–April 1954. (Reproduced by Anne Arundel County Health Department.)

Meeting Medical Manpower Shortages in Virginia

EDGAR J. FISHER, Jr.

THE CHALLENGE of a statewide shortage of medical manpower has been met by the Virginia Council on Health and Medical Care with a program which placed 300 physicians, mostly in rural areas, within 9 years; by a similar placement program for dentists, medical technologists, and X-ray technicians; and by a statewide recruitment drive among high school and college students for all types of medical manpower.

The Virginia Council on Health and Medical Care, a private, voluntary, nonprofit organization, has among its objectives the coordination of official and voluntary groups in Virginia which have mutual interests in health and medical care. It serves as a clearinghouse on health and medical care problems and programs and assists in eliminating duplication of work and overlapping of programs.

The council was formed in 1946 because Virginia's people believed that they were not getting the health services to which they were entitled, and a number of surveys revealed shocking statistics which proved their point. It was the belief that if all groups of the State working in the field of health and medical care could exchange ideas and work together much could be accomplished to improve existing facilities and services.

Financial support for the Virginia council comes from annual memberships or contributions in varying amounts from statewide and local organizations and agencies, industry, banks, hospitals, foundations, individuals (including about 600 physicians), and other sources. The 1960 budget of the council is $66,000.

Activities of the council have also included the Nemours Foundation conferences on handicapped children, an annual nutrition forum, surveys, and exchange of information. The placement of physicians was organized in cooperation with the Medical Society of Virginia, the Medical College of Virginia, the University of Virginia, and the Virginia Department of Health.

In the course of these activities, it was obvious that the chief handicap to health services in the State was the shortage of qualified workers in hospitals, public health agencies, mental institutions, medical schools, and related organizations. A lack of registered nurses prevented the opening of new wings to hospitals. There were not enough technologists to meet the demands upon laboratories. Health departments suffered a shortage of directors, sanitarians, nurses, and other personnel. Full-time teachers were needed in medical schools. Except for patients, there were few if any categories with a full quota in the mental institutions. The efforts of voluntary agencies to meet specific challenges to health also were frustrated by the need for additional trained health workers.

And yet, no precise measure of the need or the shortage was available. It was apparent that before the need could be appraised and defined, the council would require a staff to determine the facts, analyze them, and initiate the specific steps necessary. Several years of attempts to function through committees, meetings, and conferences had resulted in little gain. In May 1958, Cynthia N. Warren, R.N., who had been executive secretary of the Kentucky

Mr. Fisher is director, Virginia Council on Health and Medical Care, Richmond, Va.

State Association of Registered Nurses for 10 years, was appointed director of the health personnel program. The program was started with a grant of $10,000 from the Old Dominion Foundation and with council funds to match.

For a beginning, she limited her plans to professions associated with hospitals, which employ most health workers. A preliminary survey of Virginia's hospitals, compared with results of a 1957 survey conducted by the American Hospital Association, found them below the national average in every category of health personnel. With this information as an indication of need, a more detailed survey was conducted to help in planning effectively for recruitment and administration. The following information was solicited:

1. The number of personnel presently employed in each of a selected group of professional, nonprofessional, and clerical positions in Virginia hospitals, broken down into 48 categories.
2. The number of additional personnel needed in the 48 categories being studied.
3. Salaries and hours of work.
4. Fringe benefits provided for personnel.

This information, completed in June 1959, in cooperation with the Virginia Hospital Association and other groups, covered all but two hospitals in the State with 25 beds or more.

Dr. Huldah Bancroft, biostatistician, retired from Tulane Medical School, analyzed the data and prepared the report for publication.

Meanwhile, beginning in the fall of 1958, the council invited representatives of State professional societies and associations in the health field to confer on the question of setting up a State committee for recruitment. The conferees understood that individual organizations would still be responsible for recruiting to their own ranks, and that the council would simply employ a full-time staff member to fill in the gaps, categorical or geographic. After consultation with executive boards and members, all agreed to join the Health Careers Recruitment Committee. Since the committee was organized, it has expanded to represent 33 associations and agencies (see list).

One of the committee's first activities was to find out what recruitment brochures or pamphlets were available from each of the member professions. Forty-two were collected. A questionnaire sent to junior and senior high schools in Virginia, both public and private, listed the names of the pamphlets and asked the schools to check those which were available to students through the counselor's office or the library. Schools were asked also if they had the "Health Careers Guidebook," published by the National Health Council. In this way an original contact was made with all schools through the cooperation of the Virginia Department of Education.

It was discovered that relatively few schools had adequate information on careers in health. The professions supplied the Virginia council's office with enough copies of each pamphlet to compose a packet of 42 different brochures for distribution to every school. Only the "Health Careers Guidebook" was distributed by the National Health Council directly to the schools requesting it. As a result of these actions, the young people in Virginia's schools had direct access to information on 18 different health careers, in most instances for the first time.

To supplement the materials from national organizations, it was felt that there was a need for pamphlets specifically designed for and geared to use in Virginia.

The committee first prepared a simple threefold throwaway flier, called "Hey, About to Choose a Profession?" carrying general factual information about personnel needs in the health field. The last section of the flier, designed to be torn off, listed the 18 careers on a form to facilitate requests for specific information from the council. At the end of each month, these inquiries are tabulated and the names and addresses of the possible recruits are referred to a representative of the specified profession, who sees that this evidence of interest on the part of the student is then followed up with a letter and frequently with a personal call. According to the interest expressed, the call may come from a local physician, dietitian, pharmacist, physical therapist, or other professional living close to the student. By this means, the interest is explored and cultivated.

The largest number of requests for more information has come from students inquiring about professional nursing. Then, in order of frequency of requests, these professions fol-

lowed: X-ray technology, practical nursing, physical therapy, social work, medical technology, medicine, pharmacy, occupational therapy, medical record library science, dietetics, dentistry, veterinary medicine, hospital administration, audiology and speech correction, public health sanitation, podiatry, and health education.

The "Hey" flier is distributed in schools where the director of the health personnel program meets the students in assembly. It is supplied to hospitals by Blue Cross, and it is given out at fairs, meetings, conventions, and through organizations. Better than 10 percent of the students who have heard about the program on health careers write to the council's office for further information about one or more of the 18 professions.

The committee has issued for each of the 18 a fact sheet giving information on the type and length of education, tuition, scholarships, income, and opportunities. A set of these sheets has been placed in all Virginia high schools. Individual sheets are sent to young people requesting information on a specific career. It is the first time in Virginia that such a collection of information has been brought together. The sheets are used as sources of information by school administrators and guidance counselors as well as by hospital administrators and others.

Also designed especially for State use, "Health Career Opportunities in Virginia" was published, with information on 13 professions. Since then a new edition, "Your Future in a Health Career," has been published with information on all 18 careers. This brochure gives a brief description of each and lists the approved schools in Virginia under each profession. The pictures used and the written statements were provided by the professional societies concerned. Ten thousand copies of "Opportunities" were distributed during the 1959–60 school year, at a cost of 9½ cents each. The new booklet, of which 20,000 copies were printed at a cost of 7¾ cents each, will be used starting with the 1960–61 school year.

A "Health Careers Information Chart" is the most recent recruitment aid to be developed. It is 22½ inches by 29 inches. The 18 professions are listed down the left-hand column, and across the top of the chart the following categories are found: nature of work, education and training, Virginia schools, where employed, employment outlook, and where to write for more

Agencies Represented

American Cancer Society, Virginia Division, Inc.
Licensed Practical Nurse Association of Virginia, Inc.
Medical Society of Virginia
Podiatry Society of Virginia
Speech and Hearing Association of Virginia
State Department of Education
State Department of Health
Virginia Association of Hospital Auxiliaries
Virginia Association of Hospital Pharmacy
Virginia Association of Medical Assistants
Virginia Association of Medical Record Librarians
Virginia Association for Mental Health, Inc.
Virginia Chapters, National Association of Social Workers
Virginia Congress of Colored Parents and Teachers
Virginia Congress of Parents and Teachers
Virginia Dietetic Association
Virginia Federation of Women's Clubs
Virginia Heart Association
Virginia Hospital Association
Virginia League for Nursing
Virginia Occupational Therapy Association
Virginia Pharmaceutical Association
Virginia Physical Therapy Association
Virginia Society for Crippled Children and Adults
Virginia Society of Medical Technologists
Virginia Society of X-ray Technicians
Virginia State Dental Association
Virginia State Federation of Colored Women's Clubs
Virginia State Nurses Association
Virginia Tuberculosis Association
Virginia Veterinary Medical Association
Women's Auxiliary to the Medical Society of Virginia
Women's Organization National Association Retail Druggists, Richmond Chapter

information. A fund of valuable facts are available at a glance. The chart can be placed on a bulletin board or under the glass top on a desk. It has been sent to all Virginia high schools and hospitals.

A Virginia health careers poster has been displayed in schools, hospitals, and on bulletin boards. An exhibit for schools and conventions has been helpful in attracting prospective health workers to stop and confer.

A set of colored slides showing the professions in action are used in assembly programs along with a commentary on each career. Here again, as with all other career material that has been developed through the Virginia council, the professional societies participated. They arranged for the posing of the action pictures, and they supplied the accompanying commentary. Special projection equipment was purchased by the council so that the slides can be shown under any conditions which might exist in schools.

The major emphasis in the activities of the Health Careers Recruitment Committee has been centered on assemblies held in 74 high schools and 3 junior colleges during the 1959–60 school year. Through these assemblies, the director of the health personnel program has spoken to approximately 20,000 students. Some 1,200 interested adults were reached in 18 other meetings before civic groups, PTA's, women's clubs, and the like.

The director is invited to a community or a county where all local arrangements are made by her sponsoring organizations, which may be a hospital auxiliary, a women's club, a PTA, a local hospital administrator, or executive of a local voluntary health organization. Her itinerary is arranged so that she often speaks in as many as three schools in a day. In one county or a section of the State, she may speak in all high schools within 2 to 5 days. She prefers an assembly of all students from the 8th grade through the 12th. Following a film, "Helping Hands for Julie," which describes nine professions, she discusses the other nine with the use of a flannel board. When time allows, a question period follows. She also confers with individual students.

On request, she arranges for students to visit a nearby medical center or professional school for firsthand observation. When a school requests assistance in planning a career program, the council's office will arrange for representatives from health professions, to be chosen by the school, to be present and participate. It also supplies a list of available films on careers, compiled by the council and mailed to all counselors in Virginia schools. The list was sent to the Virginia State Department of Education with the suggestion that up-to-date films on careers in health be included in the next publication of their film catalog, and be purchased when not available through the film library.

Through this "package" recruitment program, Virginia now has one central office which serves as the clearinghouse for all health career information. A guidance counselor need contact only the Virginia council to get the health careers information which is available and needed. This saves much time and promotes a more effective program as experience has shown that busy counselors and others do not take the time or trouble to search out and contact a multitude of professional organizations, few of which have a central office where information can be readily obtained.

What are the results of this recruitment program after its first school year? Is it accomplishing the purpose of getting more young people actively interested in careers in health? In an activity which involves 33 different organizations and touches thousands of students, their teachers, counselors, and others, measurement of achievement is difficult. It is reported by the Virginia Dietetic Association that the enrollment in one of the colleges which prepares dietitians increased as a direct result of the council's program. Applicants for the September 1960 class at the School of Physical Therapy at the Medical College of Virginia have doubled over last year, and requests for information have increased considerably.

More than 20,000 students were given factual information on 18 health professions in one academic year, and of these more than 2,000 took the initiative to write to the council's office for more information.

There have been other specific accomplishments of the Virginia council's careers program. For example, certain misinformation

listed in college catalogs has been called to the attention of college administrators and appropriate corrections have been made. Many guidance counselors are now more aware of the opportunities open to their students for careers in health. And obviously by providing school administrators and students with facts, with recruitment materials, and with one office which serves as a clearinghouse for all recruitment information, the council has made it relatively simple for Virginians to become informed and stay informed about the opportunities in careers in health.

Considering the limited budget—approximately $16,000 was spent in 1959—and the fact that there is only one person to cover so large a State, the initial results appear to have been gratifying, encouraging, and worth while.

Although the approach differs necessarily from place to place, a pattern is being developed which may possibly apply in other States where a spirit of mutual confidence and trust prevails among the professional societies and associations. Virginia is fortunate to have leadership in its professional groups which promotes cooperation on matters of general concern.

The Health Careers Recruitment Committee, for the future, hopes to do a study to determine personnel needs related to population growth, available educational facilities, and other factors; to compile a directory of scholarships; and to extend its services. Although 20,000 young people were reached during the first school year of this personalized recruitment program, this is only a small percentage of the students who, as soon as possible, are candidates for information on opportunities in the health professions.

Biological Works Translated

The American Institute of Biological Sciences is translating and publishing seven Russian research journals in biology, with support from the National Science Foundation.

The journals are *Doklady: Biological Sciences Section; Doklady: Botanical Sciences Section; Doklady: Biochemistry Section; Plant Physiology; Microbiology; Soviet Soil Science;* and *Entomological Review.*

In addition to the journals, the AIBS is translating and publishing selected Russian monographs in biology. So far work has been completed on seven monographs: "Origins of Angiospermous Plants" and "Essays on the Evolutionary Morphology of Plants," by A. L. Takhtajan; "Problems in the Classification of Antagonists of Actinomycetes," by G. F. Gauze; "Marine Biology," Trudi Institute of Oceanology, volume 20, edited by B. N. Nikitin; "Arachnoidea," by A. A. Zakhvatkin; "Arachnida," by B. I. Pomerantzev; and "Plants and X-rays," by L. P. Breslavets.

Additional information may be obtained from the American Institute of Biological Sciences, 2000 P St. NW., Washington 6, D.C.

An Emergency Childbirth Service in Civil Defense Planning

GEORGE MOORE, M.D., M.P.H., and CATHERINE M. SULLIVAN, R.N., M.S.

A MUCH expressed need in the civil defense health service program has been a guideline for organizing a special emergency service to assist expectant mothers during and after time of major disaster. Indeed, the authors' file on emergency childbirth comprising material prepared by State and local civil defense organizations is remarkably thin.

Professional nursing journals have published several articles relative to the practical and technical aspects of emergency childbirth (*1–4*). Training manuals have been prepared by civil defense offices in a few States and in Canada (*5–7*), and instructive literature has been issued by official and private organizations at the State and local levels (*1,8,9*). Civil defense organizational and operational guidelines, however, have been generally lacking.

That many people have been concerned about the survival of our unborn babies in the event of a thermonuclear war is reason enough to outline a practicable approach to the organization and operation of an emergency childbirth service.

Underlying Assumptions

Assumptions basic to planning effective civil defense programs consider conventional as well as atomic weapons, and chemical, biological, and psychological warfare. Civil defense planning is based on the requirements for meeting an attack where the maximum size weapon used would be a 20-megaton thermonuclear bomb. Blast and heat from such a weapon burst are tremendous. Average homes would be partially destroyed at 20 miles from the point of detonation and secondary fires may result at 30 to 40 miles. Survival from such a blast depends on two factors, distance and underground protection.

In order to put miles between such a weapon burst and ourselves, we plan for evacuation. At present, the National Warning System (NAWAS) of the Office of Civil and Defense Mobilization is expected to give most designated target cities 2 to 4 hours of warning against surprise attack from aircraft. Hence, evacuation plans from the heart of metropolitan areas have been prepared, employing the best in engineering technology. At the same time, a program in family shelter protection has been inaugurated. If there is not sufficient time for evacuation, the public is expected to seek immediate protection in basements and underground shelters prepared by themselves. Evacuation plans should never be minimized since there is possibility of evacuation in a strategic warning (probable attack), tactical warning (imminent attack), if time permits, and in a time-phase period following attack from highly radioactive areas.

The hope of millions of target-area evacuees is to eventually reach the reception areas which escape destruction. The dispersal of the target area population in these areas, generally rural, presents tremendous problems in resources and facilities for the host services. A strong mutual aid program between target and reception area

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civil defense personnel is essential in the present survival preparedness period for successful operation of all services and subsequent mobilization, victory, and rehabilitation.

The thermonuclear surface-burst weapon complicates the matter further. From such a burst, radioactive particles are sucked up into the atmosphere and carried long distances by prevailing winds. Since most radioactive particles are heavy, they gravitate to the earth in time and create radioactive fallout. The fallout can be lethal nearest the blast area and injurious even to those downwind a few hundred miles away unless the population is warned and takes appropriate shelter.

In a successful mass attack involving many strikes, a high percentage of the Nation's population would have to take cover to escape death and injury. Civil defense authorities urge that every American should prepare to live underground in a home shelter for at least a 2-week period and should stockpile water and provisions accordingly (*10*). In addition, it is recommended that at least one member of a family group be trained in first aid and home nursing. The family must be prepared to solve its own emergency medical and health problems as well as to assist others in need. Organized medical care may not be available until radioactive fallout has decayed sufficiently to permit surface operations. Since this condition may last for days or even weeks, survival in this period could be a starkly personal matter.

At the end of the waiting interval, the existing and emergency hospitals not destroyed should be able to activate the medical care service. The correlation of millions of sick and injured, both casualties and noncasualties, with severe destruction of target area hospital beds will press this Nation sorely to care for the large number of critically sick and injured people. Hospitals crowded with patients in priority treatment categories will not be able to admit women in normal labor. The private practice of medicine may be discontinued temporarily as the too few remaining professional people will be working to save life in the hospitals and treatment stations.

During the first 2 weeks or more following enemy attack, most people will of necessity be underground in their isolated places of refuge. Exposure to radioactive fallout on the surface must be avoided. Babies will be born in basements and shelters without professional attention with relatives and possibly neighbors serving as best they can under the circumstances. In fact, the catastrophic attack may accelerate the birth of many babies prematurely because of fear and exertion on the part of the expectant mothers.

It is at once clear that both in the "take cover" period as well as the months after attack, the home remains the basic unit in the development of an effective emergency childbirth service. Self-help and help from neighbors in the initial postattack phase and organized home delivery service programs later are prerequisites for maintaining the health and longevity of our next generation. We can expect unnecessary loss of infants, imputable to our own neglect, if we are not prepared.

Self-Help and Neighbor Help

The civil defense director of a particular area is administratively responsible for the training of the public in the self-help and neighbor-help program. He will draw on physicians and nurses, hospital and medical auxiliaries, health and welfare agencies, and other related official and private organizations to cooperate in the program. In New York, the State civil defense commission and department of health have prepared a training guide and manual entitled "Assisting at the Birth of a Baby After Enemy Attack if no Doctor is Available." The guide, which may be considered a pilot venture, represents an organizational plan and teaching outline for special groups. The training course is considered a supplement to the program of self-help and neighbor help for the injured.

The Michigan State Medical Society has prepared an instruction sheet on emergency childbirth which is being distributed by private physicians to their obstetrical patients. On diagnosis, the expectant mother receives the instruction sheet and an explanation from her physician on what she must do to help herself if an attack should take place before the end of gestation. The Police Training Foundation of Franklin Park, Ill., has published a manual for policemen who are often confronted with emer-

gency childbirth. Consisting of 64 pages with 30 illustrations, the manual is designed to serve as the basis of a training program as well as a reference for the layman in the actual handling of emergency childbirth. A suggested training course is included with the booklet.

Also, the Maternity Center Association of New York City has issued reprints of "Bomb Born Babies" (*1*), an article published in a nursing magazine in 1951; and instructional pamphlets have been prepared by the Wisconsin State Board of Health and by Georgia and Canada.

Home Delivery Service

Understandably, those hospitals able to function in areas free from fallout or where fallout has decayed to permissible levels may not be available to pregnant women at any time. Pressed by enormous medical loads and limited by lack of hospital beds, physicians and nurses cannot consider a normal delivery to be of first priority. Not only will many hospitals be jammed with a cumbersome increase in patients, but facilities may be extensively contaminated with septic exudates from surgical and burn cases as well as with dangerous wastes from the irradiative injured. Under these conditions, the expectant mother's home becomes the most practical and safest facility in the post-fallout period. Linens, toilet facilities, intimate family care, and above all, cleanliness and privacy satisfy most requirements of a safe delivery. Professional assistance should be provided to the woman in labor as soon as the medical care service can absorb this function, radiation permitting.

Inasmuch as the establishment of a home delivery service is an emergency civil defense function and because the home is the fundamental facility, the civil defense emergency welfare service (*10*) should develop the framework of organization in cooperation with the health and medical service. In each welfare center, the social welfare services division of the emergency welfare service should arrange for a home delivery service in association with the county health and medical service. As described in most State operational survival plans, the welfare center is a geographic and service unit organized by county and city welfare departments to provide emergency services of registration and information, food, clothing, housing, financial assistance, and social welfare for the surviving population. A reception city or county may have several such welfare centers, each supporting approximately 10,000 persons including resident and expected evacuee populations. Each welfare center's home delivery service should cover the same population area.

During the present survival preparedness period, each welfare center director, in cooperation with the county health and medical service, should determine expected birth rates under disaster conditions and organize sufficient numbers of mobile teams embodying trained lay and paramedical personnel ready for emergency call. Health manpower priorities for casualty care do not contemplate the deployment of professional groups including medical students to normal delivery services.

Teams of two women each should be equipped with emergency kits and trained by professional medical personnel. Public health nurses have the experience to coordinate the professional relationships of this welfare center program while the availability of trained lay midwives in some rural reception areas may mitigate the need of training still another group. For the anticipated welfare center district averaging 10,000 people, including expected evacuees, 10 teams of 2 women each should be trained in emergency delivery. Trainees should have completed basic courses in first aid and home nursing and be dependable and mature.

After fallout has decayed to levels permitting surface operations, the home delivery service may function as follows. When an expectant mother goes into early labor, the family contacts its welfare center headquarters and a home delivery service team proceeds immediately to the home. The team provides complete care for a normal delivery. At welfare center headquarters, a nurse-midwife or a public health nurse with special training stands by to assist the team by telephone or messenger, if necessary. She does not leave headquarters since she must be available to give instructions to all teams wherever they may be in the wel-

fare center area. In turn, communication is available to her from a standby physician, preferably an obstetrician, at the nearest hospital. This single physician may act as consultant to all welfare centers in the area. He determines whether or not a complicated case should be admitted to the hospital.

In this manner, the home delivery service can be managed with a minimum number of professional personnel. Yet, the home delivery service is assured of trained personnel working under continual professional direction. That this system can work efficiently is demonstrated by similar operations in rural Alaska. As the medical profession realizes the necessity of such an emergency service, they should cooperate to insure the highest quality of training of lay personnel sufficient to cope with most normal deliveries. The trainees will be expected to recognize a dangerous condition early enough to ask for transmission of the patient to a hospital.

The problem of implementation in the past has been a general want of instructional materials. This has now been met to a certain degree.

Reception area counties must carry the full burden of organization and training for the home delivery service since it is here that the program will necessarily serve the surviving population. By mutual agreement, target cities will train supplementary personnel who will work in the reception areas after evacuation under the direction of the host county civil defense organization. In sparsely populated rural counties which plan to double and triple their population with evacuees, the target city may be asked to contribute most, if not all, of the home delivery service personnel.

It should be emphasized that the development of an emergency service such as this needs careful community interpretation. Every effort should be made to discuss it with representatives of those groups which may ultimately be involved in conducting the program. Needless to say, the program must have the support of the county medical society.

Training courses should stress that the lay assistant is not expected to assume the functions of a physician. The trainee is taught that childbirth is a natural process which, in most cases, will proceed to a happy conclusion without interference. The acquired knowledge should be considered as emergency aid to be used only in the event of a disaster situation resulting from enemy attack when professional assistance is not available. It will be used when women in normal labor cannot be admitted to hospitals which are crowded with seriously sick and injured patients whose care and treatment categories have priority.

Health and medical service personnel must be an integral part of the program in order to help select supplies as well as to provide training and controls. Welfare, responsible for the basic framework of organization, transportation, communications, and supplies, is also responsible for the success of this emergency civil defense program.

Summary

An appraisal of assumptions underlying present planning to meet a possible thermonuclear attack on this Nation evinces the need for an emergency childbirth program. The development of a program to insure the survival of our unborn babies should be the responsibility of health and medical as well as emergency welfare services. Priorities in medical care for millions of expected casualties, the restrictions placed on the medical care service by loss of hospital beds and lack of professional personnel and supplies, and hazards of radioactive fallout force upon us the programs of self-help and neighbor help and a home delivery service. It is hoped that the discussion of these programs will stimulate civil defense, private medicine, and public health to prepare for the problem of emergency childbirth. A strong emergency childbirth program ready to serve at any time will insure the continuance of the American Nation in spite of a possible thermonuclear war.

REFERENCES

(*1*) Hogan, A.: Bomb born babies. Pub. Health Nursing 43: 383–385, July 1951.

(*2*) Fetter, R., Whitridge, J., Jr., and Welch, J.: Disaster insurance for mothers and babies. Bull. Maternal Welfare 4: 9–13, March–April 1957.

(3) Green, J. M.: Emergency care of the obstetrical patient. Nursing Outlook 6: 694–696, December 1958.
(4) Clark, A. L.: Childbirth during disaster. Nursing World 133: 15–17, May 31, 1959.
(5) Bartholomew, R. A.: What to do at emergency childbirth in times of disaster. Atlanta, Georgia Department of Public Health, 13 pp.
(6) New York State Department of Health and New York State Civil Defense Commission: Assisting at the birth of a baby after enemy attack if no doctor is available. Albany, September 1954, 24 pp.
(7) Webb, J. F.: Management of emergency delivery. Ottawa, Canada, Department of National Health and Welfare, Civil Defense Health Service, 1957, 10 pp.
(8) White, G. J.: Emergency childbirth. A manual. Franklin Park, Ill., Police Training Foundation, 1958, 62 pp.
(9) Wisconsin State Board of Health: Protection of mother and infant in case of emergency delivery. Madison, September 1955, 8 pp.
(10) U.S. Office of Civil and Defense Mobilization: What you should know about the national plan for civil defense and defense mobilization. Washington, D.C., U.S. Government Printing Office, December 1958, 31 pp.

Education Note

Michigan's Continued Education Service. Among the short-term courses offered for 1961 by the continued education service of the University of Michigan School of Public Health are the following:

Institute on Newer Aspects of Public Health for Health Officers, March 27–31. This second advanced refresher course in the series on "Newer Health Problems" emphasizes leadership. It is conducted primarily for health officers from the central portions of the United States and Canada, but, to the extent that space is available, applications will be accepted from health officers from other areas.

Fifth Workshop in Public Health Dentistry—Local Public Health Dental Programs, June 19–23. For local public health dentists, health officers, State directors of dental programs and maternal and child health programs, interested personnel of the Public Health Service, Children's Bureau, State and local official and voluntary health agencies, and school officials.

Included in the program are studies of local dental programs, administration, coordination of State and Federal objectives, content, and methods, epidemiological principles and application, statistical analysis, operation of clinics, preventive dentistry, specialized dental programs, and educational principles and methods.

Requests for announcements of the program or published proceedings may be addressed to Director, Continued Education, School of Public Health, University of Michigan, Ann Arbor.

Expanded Nutrition Activities. The Massachusetts Institute of Technology will create a new department of nutrition, food science, and technology, formed around the existing food technology department. The extended curriculums and research activities will place more emphasis on the basic science and biological aspects of nutrition.

The new department will be headed by Dr. Nevin Scrimshaw, director of the Institute of Nutrition of Central America and Panama (INCAP) and regional adviser on nutrition of the Pan American Health Organization.

The cooperative relationship to be maintained between INCAP and M.I.T. will offer M.I.T. students opportunity to pursue studies in association with INCAP.

AN INSERVICE TRAINING PROGRAM FOR SANITARIANS IN VIRGINIA

Adrian L. Carson, Jr., M.D.

THE DEVELOPMENT of public health services during the past 20 years has automatically carried with it a requirement for personnel able to meet the expressed needs. A higher standard of living and changes in the social structure have been accompanied by a demand for more and better trained personnel to provide those health services required by the public.

The Virginia State Department of Health recognized the situation but, despite much effort, was able to do little on a planned and permanent basis. The recruitment of sanitarians to staff the new jobs became especially difficult in 1950 and 1951. Resignations, 32.7 percent in 1951, often exceeded replacements. Many positions remained vacant for long periods.

Early in 1952, a planned program for inservice training of sanitarians was started. This type of program, tying in training with recruiting, was patterned somewhat along the lines of that used by industry. Salary changes were made. These were important but have never been so great a factor in job stabilization as has been the development of job satisfaction, largely due to the impact of inservice training.

The training program for sanitarians was the first major inservice training activity attempted within the Virginia State Department of Health. It has since served as a general pattern for additional inservice training programs developed to meet some of the needs of public health nurses, physicians, clerks, and others. Basically, the inservice training of sanitarians consists of:

- Indoctrination for the first month of employment in one of four selected local health departments under the tutelage of an experienced sanitarian who follows an accepted procedure in teaching.
- A 12 weeks' course in the basic fundamentals of sanitation at the Orange Training Center after the sanitarian has had from 3 to 12 months on-the-job supervised experience in his own local health department. The 12 weeks' work in this training facility is a planned combination of didactic teaching supplemented by practical field participation.
- Short refresher courses in special phases of sanitation from time to time as may be indicated. An example is the special training in advanced milk sanitation recently completed by all sanitarians.

The value of training to the individual sanitarian is self-evident. However, a brief appraisal of the program reveals the benefits of inservice training to the health department and to the public, with particular reference to sanitation.

Benefits to the Public

Inservice training has helped the recruitment of potential sanitarians immensely. The word

Dr. Carson before his death was director of local health services and in charge of training activities in the Virginia State Department of Health. The paper was delivered, in much the same form, at the dedication of the Sanitarian Training Center, Orange, Va., on April 15, 1959.

has got around that adequate training will be available to new appointees; consequently, suitable individuals do not hesitate to apply. They feel that they will be given an opportunity to acquire the technical know-how. An excess of applicants gives greater opportunity to pick the ones whom health department officials believe are best adapted to the needs. No longer do we have sanitarian vacancies; we have an excess of good applicants.

The indoctrination period for the first month of employment gives a second opportunity to screen the individual as to how he gets along with people, how he seems to fit into an organization, his capacity for learning, and his general adaptability. During his assignment to the field after the first month of indoctrination, the new sanitarian is closely supervised. He is not sent to the sanitarian training facility in the Orange County Health Center until and unless we are convinced he is ready for this 12 weeks' course. When the course is completed, the sanitarian is believed to have a good chance for success in his local assignment.

At Orange the sanitarian learns the basic fundamentals of sanitation and is given the advantage of learning not only the "how" of techniques, but also the "why." He learns the importance of staff relationships and how his activity correlates with the work of others on the local health department staff. He learns the practical side of things, as well as the importance of quality of work. He learns the reasons for uniformity of procedure and how to fit into and work with an organization. He learns about local government and is taught that giving the right kind of service for the individual citizen is the fundamental reason for existence of his post.

All of these things are being accomplished—some better than others—but the sum total is a greatly improved service in sanitation. All our budgeted positions are filled, and the type and quality of work being accomplished by our sanitarians place them on a truly professional level.

Of course, there may be occasional local health directors who feel that all this training is not necessary, that they cannot spare their personnel for training, and that perhaps they can get by and not have to have a 12-week vacancy.

These short interludes can always be handled by borrowing personnel for emergency assignment from within the district or from nearby areas. These difficulties are inconsequential when compared with the rapid turnover and the long-time vacancies that used to exist.

The time spent in inservice training of sanitarians, in the aggregate, is far less than that formerly required to correct "situations" which would not have occurred if the personnel had had a better knowledge of fundamentals.

Conclusion

A trained and competent group of sanitarians makes for better administration of the present-day programs. Sanitation activities as a whole are becoming much more complicated as technological advances in air pollution, radiation, vending machines, housing, swiming pools, and other areas are being brought to our attention. A well-developed inservice training program makes it possible to focus upon these new problems as they emerge.

Although circumstances forced the Virginia State Department of Health to develop the inservice training program, the values which have accrued are so manifold and so obvious that the department plans to continue and to strengthen the processes whereby these benefits are obtained.

Cystic Fibrosis: A Community Challenge

L. L. KULCZYCKI, M.D., D.P.H., and K. I. E. MACLEOD, M.D., M.P.H.

CYSTIC FIBROSIS of the pancreas, a relatively new disease entity, was brought to official recognition through the classic work of D. H. Andersen in 1938 (*1*). Today a confirmation of the diagnosis of this disease is no longer postponed until postmortem examination, but may be established within a matter of hours, and the life prolonged for years. The classic pattern of this disease has also changed, since many of the clinical manifestations are conditioned by modern medical care which in many instances prevents or delays the appearance of manifestations or at least ameliorates the severity of the disease.

In experienced centers and hands, meconium ileus, an early complication of the disease, is diagnosed and treated at once, gastrointestinal symptoms are corrected promptly, and pulmonary infection is prevented or treated adequately. On the other hand, in many regions this disease is still unknown, and it may serve as an excellent example of how many clinical and research contributions are needed to alert the medical world to its existence. Among several hundred papers dealing with cystic fibrosis, those of Andersen (*2*), Baumann (*3*), Bodian (*4*), di Sant' Agnese and Vidaurreta (*5*), and Shwachman and associates (*6*) are regarded as comprehensively informative. In addition to the references in this paper, the National Cystic Fibrosis Research Foundation can be consulted for the detailed literature on the clinical, laboratory, and research aspects of the disease.

Like many other diseases of infancy, childhood, and adolescence and the chronic diseases which afflict adults, cystic fibrosis is gaining increasing recognition as a public health problem which envelops the family unit. The community is concerned because the family may have to fall back upon it for assistance and, indeed, is likely to do so because of economic factors. Communities and health departments in the United States have met such problems before with considerable imagination, ingenuity, work, and public support. It is our purpose to present evidence that cystic fibrosis requires such tactics.

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Incidence

The facts are still being accumulated on the incidence of this disease among the people of the United States. Andersen and Hodges (*7*) calculated in 1946 an incidence of cystic fibrosis of 1.73 per 1,000 live births in the New York area; in 1958 Andersen (*2*) estimated the prevalence of cystic fibrosis in the United States as 0.7 to 1.7 per 1,000 live births. Goodman and Reed (*8*) give a rate of 0.7 to 1.0 per 1,000 live births, and our own data for the Massachusetts area (*9*) indicate an even greater incidence, as high as 1 in every 600 newborn infants. Baumann (*3*) calculated the incidence for the Swiss population as 7.22 new cases per 10,000 births per year. A national hospital survey of cystic fibrosis (*10*) indicates that 2,525 persons were hospitalized in the United States in 1957 because of cystic fibrosis, and one out of every six or seven died. The annual number of deaths attributed to this disease during the 1952–57 period ranged from 295 in 1952 to 475 in 1955 to 359 in 1957. In the bigger pediatric hospitals cystic fibrosis may represent 3 percent of autopsies and 0.2 percent of hospital admissions (*2, 10*).

The real extent of this disease, cystic fibrosis

of the pancreas, and its distribution among the general population is still unknown. Several factors are partially responsible for this. Official medical statistical listings omit this fairly young pathological entity. For example, the Standard Nomenclature of Diseases and Operations included cystic fibrosis of the pancreas for the first time in the 4th edition (1952), but without recognizing the modern interpretation of the disease, that is, as a systemic disease involving not only the pancreas but many other organs, particularly the respiratory system, paranasal sinuses, liver, rectum, and sweat glands.

The Manual of International Statistical Classification of Diseases, Injuries, and Causes of Death (seventh revision, 1955) codes only fibrocystic disease of the pancreas. It should be emphasized that fibrocystic disease of the lung (congenital), fibrocystic disease of other organs, and cystic disease of the lung, liver, or other organs are quite different clinical and pathological entities and should not be confused statistically, or otherwise, with cystic fibrosis of the pancreas. Indeed the name, cystic fibrosis of the pancreas is now an obsolete, misleading, and completely inadequate term for describing the clinical and pathological picture of this disease entity.

Several other misnomers are also being used for cystic fibrosis: fibrocystic disease, mucoviscidosis (Farber), mucosis (Bodian), mucositis (Michalowicz), dysporia entero-broncho-pancreatrica familiaris (Glanzmann), and exocrinosis (di Sant' Agnese). The monthly *Index Medicus* uses pancreatic cystic fibrosis with cystic fibrosis, fibrocystic disease of the pancreas, and mucoviscidosis as cross references.

Until a better name is coined, clinician, pathologist, and statistician should be familiar with this clinical pathological entity as described in different countries by these various names. With the present medical and official international statistical listings, this disease, even when diagnosed, is not being reported statistically or may be coded under "other diseases of pancreas."

Many cases are diagnosed late or misdiagnosed, particularly when the predominant signs and symptoms point to organs other than the pancreas. Frequently, an incomplete and symptomatic diagnosis is made, such as bronchitis, emphysema, bronchopneumonia, bronchiectasis, atelectasis, sinusitis, nasal or intestinal polyposis, rectal prolapse, malnutrition, anemia, vitamin deficiency, intestinal obstruction, congenital intestinal abnormality, portal hypertension, heat prostration, or hypoproteinemia. All these conditions may occur as one or more complications of cystic fibrosis but as such are not yet included in the statistical coding with direct reference to cystic fibrosis, as the disease is understood either in modern teaching or clinical experience or both.

Even if diagnosed and treated correctly the disease may not be enumerated in the vital statistics, since this entity is not a reportable disease. Only hospitals with a large pediatric service, taking a particular interest in this disease, may provide pertinent mortality and morbidity statistics for cystic fibrosis in the area they serve. Cystic fibrosis may be responsible for as much as 5 percent of all deaths in these hospitals. Some State departments of health (Massachusetts, Connecticut, Rhode Island, and Maine), which supervise health programs for persons with this disease, may have accurate and up-to-date data of the incidence of cystic fibrosis among the population in their jurisdiction (*11*).

Characteristics of Cystic Fibrosis

Increasing knowledge of the disease indicates that cystic fibrosis is inherited (*3*, *4*, *7*, *12*) and may originate during fetal life. About 10 to 15 percent of the patients are born with intestinal obstruction (meconium ileus) (*13*). Apparently the effect of the absence of pancreatic enzymes is that undigested, tenacious meconium blocks the ileum or some other part of the intestine. Nowadays this emergency is usually corrected surgically, but absence of pancreatic enzymes leads to nutritional and growth disturbances that must be corrected continuously by dietetic supplements of enzymes and vitamins. Even when such replacement therapy is successful, pulmonary changes may still appear, or they may occur independently. The accumulation of bronchial secretions fre-

quently precipitates severe pulmonary phenomena, leading to persistent bronchitis, atelectasis, emphysema, bronchiectasis, and peribronchial and generalized pulmonary involvement (*14*).

Clinical manifestations of cystic fibrosis vary according to age of the patient at onset, progress of the disease, and response to therapy (*2, 5, 6*).

Diagnosis

The diagnosis of cystic fibrosis is based on clinical manifestations and laboratory results. These include a complete or partial deficiency of pancreatic enzymes (*15*), abnormal concentrations of sweat electrolytes (*9*), pulmonary obstructive phenomena, and other important features supplemented by a detailed clinical and family history (*16*). No single clinical manifestation or laboratory test can absolutely determine the presence or absence of this disease or rule out other possibilities (*4–6,17,18*). Currently, analysis of sweat electrolytes is probably the most reliable single test to confirm the diagnosis when other manifestations are present (*9*).

The lack of pancreatic enzymes is prevalent in approximately 80 percent of the patients, many of whom have some signs of malnutrition in spite of replacement therapy. History of rectal prolapse is present in about 25 percent (*19*), and intestinal complications including meconium ileus, intussusception, and fecal impaction in about 20 percent (*2,13*). Other conditions of cystic fibrosis found not infrequently are portal hypertension, biliary cirrhosis, congestive heart failure, nasal polyposis, diabetes mellitus, heat prostration, and hypoproteinemia (*5*). Shwachman and Kulczycki have also noted similar findings in their series of cases (unpublished data).

Some cases, however, present a diagnostic challenge and require considerable clinical experience and a searching interpretation of the laboratory tests. We are aware of patients who were treated for psychiatric conditions or for tuberculosis, allergy, or rectal prolapse or who have had segments of the lung removed (*14*), but in whom the true nature of the disease was not recognized for many years. In some cases, the physician or surgeon overlooks this disease completely, and incorrect diagnoses will continue to be made until cystic fibrosis is more widely recognized. We are also aware that postmortem findings may be wrongly labeled if the pathologist is not aware of the disease (*20*).

Genetic Aspects

Genetic studies indicate that cystic fibrosis is a hereditary disease and that the genetic makeup of each parent may contribute to the appearance of this disease in the offspring (*3,7,8,16,21,22*). Andersen and Hodges (*7*) point out that cystic fibrosis is transmitted as an autosomal recessive gene.

The work of Lowe and co-workers (*18*) in 1949 with 95 families indicated that some heterozygotes may eventually survive and reproduce. Goodman and Reed (*8*) stated in 1952, "Fibrosis of the pancreas is a simple recessive trait which causes the eventual death of infants and children, and genetically speaking, is a lethal gene." These authors assume that the lost gene is replaced by mutation from the normal to abnormal allele; their calculation of the mutation rate for cystic fibrosis is expressed as 0.7 to 1.0×10^{-3}. According to their investigation, 1 in every 16 to 20 persons carries this gene. Baumann (*3*) thinks that the gene balance is maintained because of an increased instinct of progeniture in individuals with these genes; that is, Swiss families with mucoviscidosis have 4.27 children each, while "healthy" families have only 2.48. Baumann's conclusion is that the gene does not behave in a purely recessive way and "the genotypically homozygous individuals are affected phenotypically; the parents of homozygous patients are heterozygous, genotypically sick but phenotypically healthy individuals showing rarely microsymtoms (increased electrolytes in perspiration)." Hsia (*21*) includes cystic fibrosis in the group of heterozygotes "for which the evidence appears to be reliable and has received independent confirmation."

Much clinical and laboratory observation is being accumulated supporting the view of partial gene penetration and an incomplete expression of the disease in many patients (*3,23*).

More than 80 percent of the patients lack pancreatic enzymes; others have various degrees of pancreatic insufficiency, and a few have sufficient enzymes (*5,15*). More than 80 percent of the patients have pulmonary involvement of different degrees of severity. A few are free of pulmonary manifestations, or show mild pulmonary changes only at a later age (*14,23*).

The symptoms and signs of cystic fibrosis may appear singly or in combinations, early or relatively late in life. Koch (*24*) stated that hereditary mucoviscidosis is more frequently noticed among adults than infants and children. Peterson's study (*23*) and our own observation indicate a possibility of many cases of unrecognized cystic fibrosis among adults. Baumann (*3*) confirmed an observation by di Sant' Agnese (*25*) and Shwachman (*6*) stating that a significant percentage of parents and siblings may have elevated sweat electrolytes without clinical manifestations of the disease. All observations point to the fact that birth order has no correlation with affected siblings. In some families only the 9th or the 11th offspring has been affected, and in others all three, four, or five siblings are affected (H. Shwachman and L. Kulczycki, unpublished data). There is no sex predominance (*3, 6*). Steinberg and co-workers (*22*) analyzed 141 families and found known consanguineous mating in only one. But Baumann's geneological research in Switzerland showed siblings in closely related families.

The statement made in the past that the disease is usually fatal within the first year of life reflected only helplessness, stated so vividly in 1942 by Attwood and Sargent (*20*): "Cystic fibrosis of the pancreas is seldom correctly diagnosed prior to death, and may be even missed at autopsy." The proper management of the patient may suppress the progress of the disease, change its clinical pattern, and extend the life of the patient (*26, 27*). The influence of parental intelligence and socioeconomic factors is evident and may be of significance.

Apparently both genetic and environmental factors may affect the transmission of the gene and the expression of the disease. There is a possibility that this disease may be transmitted as a dominant trait with low penetrance, or as a recessive, with partial expression (*3, 23*). Many more studies of the family, the patients, and their offspring are required to establish the specific genetic pattern of cystic fibrosis.

Survival beyond adolescence is increasingly frequent. In the few instances when the parent of a child with cystic fibrosis remarried a partner with no history of the disease, the offspring were free of cystic fibrosis. Baumann advises avoidance of marriage between members of families with known history of cystic fibrosis and suggests voluntary limitation of reproduction after the appearance of the first case. Some of the data from clinical observations and genetic studies may support consideration of their practical application, but much more research and evidence are needed before cystic fibrosis gene tracing becomes part of the premarital consultation.

Public Health Interest

Public health is concerned with this disease not only because of the need for providing essential clinical service and medical care for the patient but even more so because of the adverse economic factors. So serious a disease in the advanced stage usually requires a highly specialized regimen for the individual. An adequate program must be readily available to the family and to the patient. It should include casefinding; a center for evaluation, diagnosis, and treatment; social referral; public assistance; and other followup services. Public health has an important role to play in all these aspects. The Commonwealth of Massachusetts and other States (*11*) have already recognized this function by including patients with the disease in the State crippled children's program and by making available to them essential clinical services. Public health planning and action in this matter are conditioned by experience in handling other crippling conditions of children such as rheumatic fever, nephrosis, poliomyelitis, and chronic orthopedic conditions.

In many instances it is necessary to aid the family with cystic fibrosis in meeting its economic problems. The recently formed citizen organizations and the campaigns for public understanding of this problem may have a special value in furthering support for this concept. Parents and families directly concerned with

this disease in particular have formed local chapters of the national organization.

Summary and Conclusions

Cystic fibrosis weighs heavily upon the afflicted families. It warrants a program of aid for the individual patient and assistance to the family income to meet the expenses of necessary and continuous medical care. The community, acting through existing public health services, must help by providing for the early detection of the disease and developing facilities for casefinding, diagnosis, and treatment. A standardized nomenclature of this disease and proper pathological and statistical coding are needed. Uniform channeling of the statistical data currently available and continuously developing through followup studies is urgent.

Owing to the complexity of the disease and the difficulty in the correlation and interpretation of the clinical and laboratory findings, it is postulated that the diagnosis and management of the patient affected with cystic fibrosis should be supervised by physicians who have specialized knowledge of this relatively new clinicopathological entity. Several pediatric centers have accumulated much experience in handling the overall problem of cystic fibrosis. But any such service, particularly the supervision of nutrition, rehabilitation, breathing therapy, proper bronchial drainage, and adequate use of mist and aerosol spray, requires considerable cooperation on behalf of the patient by the parent, properly trained physician, nurse, and physiotherapist. The voluntary organization of parents and interested citizens has an important function in the development of these needed services.

REFERENCES

(1) Andersen, D. H.: Cystic fibrosis of the pancreas and its relation to celiac disease. A clinical and pathological study. Am. J. Dis. Child. 56: 344–399 (1938).

(2) Andersen, D. H.: Cystic fibrosis of the pancreas. J. Chronic Dis. 7: 58–90 (1958).

(3) Baumann, T.: Die Mucoviscidosis als rezessives und irregulär dominantes Erbleiden. Eine klinische und genetische Studie. Helvetica Paediatrica Acta, supp. 8 to vol. 13 (1958), fasc. 4, 102 pp.

(4) Bodian, M.: Fibrocystic disease of the pancreas: A congenital disorder of mucus-production-mucosis. London, Heinemann, 1952.

(5) Di Sant' Agnese, P. A., and Vidaurreta, A. M.: Cystic fibrosis of the pancreas. J.A.M.A. 172: 2065 (1960).

(6) Shwachman, H., Laubner, H., and Catzel, P.: Mucoviscidosis. *In* Advances in pediatrics, edited by S. Z. Levine. Chicago, Year Book Publishers, Inc., vol. 7, 1955, pp. 249–323.

(7) Andersen, D. H., and Hodges, R. G.: Celiac syndrome. V. Genetics of cystic fibrosis of the pancreas with a consideration of etiology. Am. J. Dis. Child. 72: 62 (1946).

(8) Goodman, H. O., and Reed, S. C.: Heredity of fibrosis of the pancreas. Possible mutation rate of the gene. Am. J. Human Genet. 4: 59–71 (1952).

(9) Kulczycki, L. L., Macleod, K. I. E., and Shwachman, H.: A survey of school children for cystic fibrosis. A.M.A. Am. J. Dis. Child. 100: 174–180, August 1960.

(10) Sirkin, M. G., Crane, M. M., Brown, M. L., and Kramm, E. R.: A national hospital survey of cystic fibrosis. Pub. Health Rep. 74: 764–770, September 1959.

(11) Dodd, S. G., and Shannon, V.: Care of children with nephrosis and cystic fibrosis of the pancreas in a crippled children's program. Am. J. Pub. Health 48: 15–21 (1958).

(12) Glanzmann, E.: Dysporia entero-bronch-pancreatica congenita familiaris: Cystiche pankreasfibrose (Syndrom von Landsteiner-Fanconi-Andersen); Eine klinische Vorlesung. Ann. paediat. 166: 289–313 (1946).

(13) Shwachman, H., Pryles, C. V., and Gross, R. E.: Meconium ileus: A clinical study of 20 surviving patients. A.M.A. Am. J. Dis. Child. 91: 223 (1956).

(14) Kulczycki, L. L., Craig, J. M., and Shwachman, H.: Resection of pulmonary lesions associated with cystic fibrosis of the pancreas. New England J. Med. 257: 203 (1957).

(15) Shwachman, H., et al.: Cystic fibrosis of the pancreas with varying degrees of pancreatic insufficiency. A.M.A. Am. J. Dis. Child. 92: 347 (1956).

(16) Ross Laboratories: Fibrocystic disease of the pancreas. (Symposium.) Columbus, Ohio, 1956.

(17) Barbero, G. J.: Diagnosis of cystic fibrosis of the pancreas. Pediatrics 24: 658–665, October 1959.

(18) Lowe, C. U., May, C. D., and Reed, S. C.: Fibrosis of the pancreas in infants and children. Am. J. Dis. Child. 78: 349–374 (1949).

(19) Kulczycki, L. L., and Shwachman, H.: Studies in cystic fibrosis of the pancreas; occurrence of rectal prolapse. New England J. Med. 259: 409–412, Aug. 28, 1958.

(20) Attwood, C. J., and Sargent, W. H.: Cystic fibrosis of the pancreas with observation on roentgen appearance of the associated pulmonary lesions. Radiology 39: 417–425 (1942).

(21) Hsia, D. L.: The laboratory detection of heterozygotes. Am. J. Human Genet. 9: 98–116 (1957).

(22) Steinberg, A., Shwachman, H., Allen, F. H., and Dooley, R. R.: Linkage studies with cystic fibrosis of the pancreas. Am. J. Human Genet. 8: 162–176 (1956).

(23) Peterson, E. M.: Consideration of cystic fibrosis in adults, with a study of sweat electrolyte values. J.A.M.A. 171: 1–6, Sept. 5, 1959.

(24) Koch, E.: Hereditary mucoviscidosis in the adult and its relationship to peptic ulcer. Deutsche Med. Wchnschr. 84: 1773–1784 (1959).

(25) Di Sant' Agnese, P. A.: Fibrocystic disease of pancreas, a generalized disease of exocrine glands. J.A.M.A. 160: 846, Mar. 10, 1956.

(26) McIntosh, R.: Cystic fibrosis of the pancreas in patients over 10 years of age. Acta paediat. 43 (supp. 100): 467 (1954).

(27) Shwachman, H., and Kulczycki, L. L.: Long-term study of one hundred five patients with cystic fibrosis. A.M.A. Am. J. Dis. Child. 96: 6–15, July 1958.

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Poultry Diseases in Public Health. Review for epidemiologists. *PHS Publication No. 767; 1960; by Mildred M. Galton and Paul Arnstein; 40 pages; 25 cents.*

Developed as a guide for epidemiologists, this review discusses and evaluates some of the reported outbreaks and sporadic cases of human diseases traceable to poultry, especially chickens. It summarizes current public health aspects of about 25 bacterial, viral, fungal, and parasitic diseases involving man and fowl.

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Abstracts of monographs, research reports, and personal accounts by Western scientists, written as early as 1947 but mainly between 1954 and 1959, deal with medicine and medical research in the Soviet Union.

Cited are about 100 research reports or literature reviews and approximately the same number of reports on medical institutes and laboratories, clinics, hospitals, and talks with Soviet scientists. This compilation is designed to assist those who cannot read Russian to acquire background information on the status of Soviet medical research.

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Health Statistics from the U.S. National Health Survey.

ACUTE CONDITIONS, incidence and associated disability, United States, July 1958–June 1959. *PHS Publication No. 584–B18; 1960; 34 pages; 30 cents.*

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